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# ECONOMIC GEOGRAPHY



## JULY

AGRICULTURAL REGIONS OF ASIA

Samuel Van Valkenburg

THE GEOGRAPHY OF CHOSEN

J. Wright Baylor

THE MISSISSIPPI RIVER—ASSET OR LIABILITY

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MECHANIZATION OF AGRICULTURE IN U.S.S.R.

Frances M. Earle

SAN LUIS OBISPO, CALIFORNIA

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## ASIA

ASIA intrigues the interest of every geographer as no other land mass can. Its vastness and variety, its great waste places, its monsoon weathers, its teeming populations—all these have no parallel elsewhere. Its history begins the history of the race. Its cultures have flourished, and crumbled to decay. Its peoples have long slumbered, but they are awakening to a new day. Its potential strength and influence in the world's further progress toward a new standard of civilization and culture are unknown and unmeasured.

To what use shall its varied vastnesses be put? Where may additional millions of men find room and sustenance among its mountain folds? Is there untold mineral wealth in its unexplored wastes and wild alpine ranges? Are there new fields awaiting new crops? Can Asia assume the place in the world's activities that her vastness of area, her variety of environments, her hordes of human workers suggest for her? Shall the Asiatic peoples work shoulder to shoulder with the European peoples, or shall there be enmity and struggle between them?

These are questions that the geographer first of all must attempt to answer; or he must determine the basic facts upon which the economist or the statesman must predicate his answer. The peace and prosperity of the world are weighing in the balance. The economic and political chaos in China, the seething social unrest in India, the rebellious subordination of the Philippines and the Dutch East Indies, the resistance to Russian reform in Uzbekistan and Turkmenistan, the discontent in the Near East, in Chosen, in Burma—everywhere the restlessness of peoples seeking the new way, dazzled by the new light, breaks the ancient calm of Asia.

The new day dawns in Asia and her people rise to greet a new order. How shall the rest of the world work with them—or suffer with them?

# ECONOMIC GEOGRAPHY

VOL. 7

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No. 3

## AGRICULTURAL REGIONS OF ASIA

### INSTALMENT I

*Samuel Van Valkenburg*

THE land utilization of Asia, probably the first of the great masses to be brought under man's dominion, can not readily be presented from the same point of view or with the same thoroughness as that of Europe, or America, or even Australia. The continent is so large that in a lifetime of travel an investigator could hardly see it all; many of the nations established upon its wide reaches are so backward that they do not, and can not, furnish trustworthy statistics.

The disadvantage of faulty or inadequate numerical data, except for Japan and its dependencies, and for the American and European possessions, prohibits the accurate delimitation of agricultural regions; but this drawback is somewhat compensated for by the rapidly increasing numbers of detailed field studies, and general descriptions that are appearing in publication. The disadvantage of vast area and the consequent impossibility of any single investigator's personally studying every part of the continent, and the innumerable examples of varied land utilization must be offset by thorough examination of the literature available.

A considerable number of treatises

on Asia and parts of Asia are now appearing in print. Not long ago such books as King's "Farmers of Forty Centuries" were rare indeed; now more comprehensive dissertations are appearing frequently. The study of Asia is passing from the hazy domain of exploration and description into the clearer realm of analysis and interpretation. The different colonizing governments and some of the Asiatic powers issue statistical and descriptive reports of the first rank; geographers, particularly of America and Germany, make personal studies of special areas or industries; the British geographer, Sir L. Dudley Stamp, writes a general textbook<sup>1</sup> on Asia that brings the study of that great continent into the field of collegiate teaching and supplies a first-rate source of general information—an interpretation that has great value as presented from the standpoint and point of view of one individual; and finally, the French geographers, under the direction of P. Vidal de la Blache and L. Gallois<sup>2</sup> contribute in the series published as *Geographie Universelle* the following masterful interpretations of Asiatic

<sup>1</sup> *Asia*, E. P. Dutton Company, New York, 1930.

<sup>2</sup> Armand Colin, Paris.



geography, brilliantly prepared and written with a wealth of detail and maturity of interpretation previously unequalled, and probably unexcelled

Haut Asie by Fernand Grenard; and to which in time will be added a volume on Asiatic Russia.

In this study, I have made use of

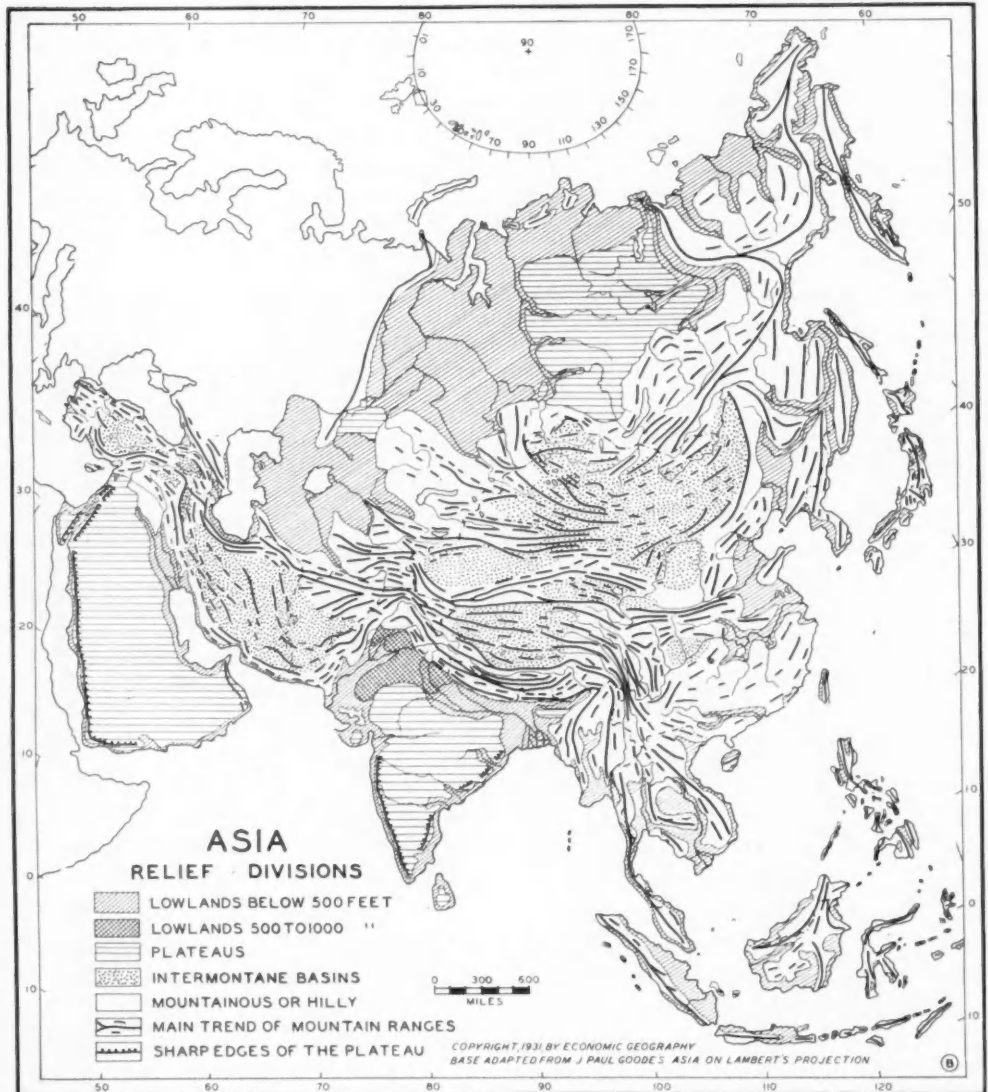


FIGURE 1.—Relief is the primary basic factor affecting the distribution of crops and types of land utilization in Asia. Mountains constitute the major areal element in Asia's relief and preclude the possibility of intensive land use over vast stretches of territory; cold, dry plateaus in the north, and hot, dry plateaus in the south further limit the profitable use of the land; and it is only on the great alluvial plains which form but a small part of Asia's total expanse that great densities of population are possible and where the most productive use is made of the land.

for many years to come: l'Asie des Monsons by Jules Sion; l'Asie Occidentale by Raoul Blanchard; and

not only the detailed and general publications accessible to me, but experiences and investigations of two

young American geographers who have studied conditions in China and Japan, Dr. George B. Cressey and Dr. R. H. Hall respectively. The latter kindly assumed the responsibility for the agricultural interpretation of the Japanese, and the former contributed invaluable information on the agricultural regions of China.

#### RELIEF

Of the two basic factors, relief and climate, affecting land utilization, the relief is considered first, since it is of primary importance. The accompanying map delimits the three principal physiographic divisions—the *Mountains* with their interior basins; the peripheral *Plateaus*; and the surrounding lowland *Plains*.

#### THE MOUNTAINS

Mountains constitute the greater part of Asia. From Europe they continue from the Balkans into Asia Minor retaining the east-European type of double-range system, widening at intervals to enclose broad intermontane basins (Asia Minor, Iran, Seistan, for instance) or narrowing in places to form cordilleran "knots" (Armenia and Pamir as examples); they radiate fanwise eastward, northeastward, and southeastward from the Pamir Plateau, to be closed ultimately by the circum-Pacific Ranges. The circum-Pacific Ranges are in some places connected with the mainland by intermontane lowlands, but in most places lie disconnected as festoons of islands (from the Malay Archipelago to the Kueriles). The radial symmetry of the ranges converged in the Pamir Plateau is disturbed by only one other mountain knot, Upper Burma, where the range suddenly shifts direction west-east to north-south. Between

the rays of the great mountain fan spread intermontane basins (Tibet, Tsaidam, Gobi, and Tarim); and where the ranges intersect the coast longitudinal valleys lie between (Irrawaddy, Menam, Mekong, Songka, Si Kiang, Yangtse Kiang, and in a subordinate, or minor manner, Hoang Ho).

Argand in his scholarly analysis "*La Tectonique de l'Asie*"<sup>3</sup> has attributed the origin of this mountain system to the horizontal displacement of two great continental blocks separated by the vast Tethys syncline. The southern block at present is represented by the plateaus of Arabia and the Deccan; the northern by the Central Siberian Plateau, the mountain systems of Southern and Northern China, and the Tarim Basin. The approach of these massifs folded the sedimentaries of the Tethys basin against the primitive blocks into mountain ranges. Three periods of approach are distinguishable, correlative with the Caledonian, Hercynian, and Alpine periods of Europe. The last period produced the present relief; the ranges resultant from the two older deformations had been reduced to peneplains in the subsequent intermissions in mountain making.

During the Alpine period, beginning with the Cretaceous and perhaps continuing at the present time along the zone of juxtaposition from Spain to Indo-China, the intervening sedimentaries were folded, overthrust, and partly "sheetfolded" over the primitive blocks both northward and southward, resulting in the typical basin-shaped relief west of the Pamir Plateau, and the "knots" representing the points where the

<sup>3</sup> *Compte rendus de la XIII<sup>e</sup> Session Congrès géologique internationale*, Vol. I, pp. 171-372.

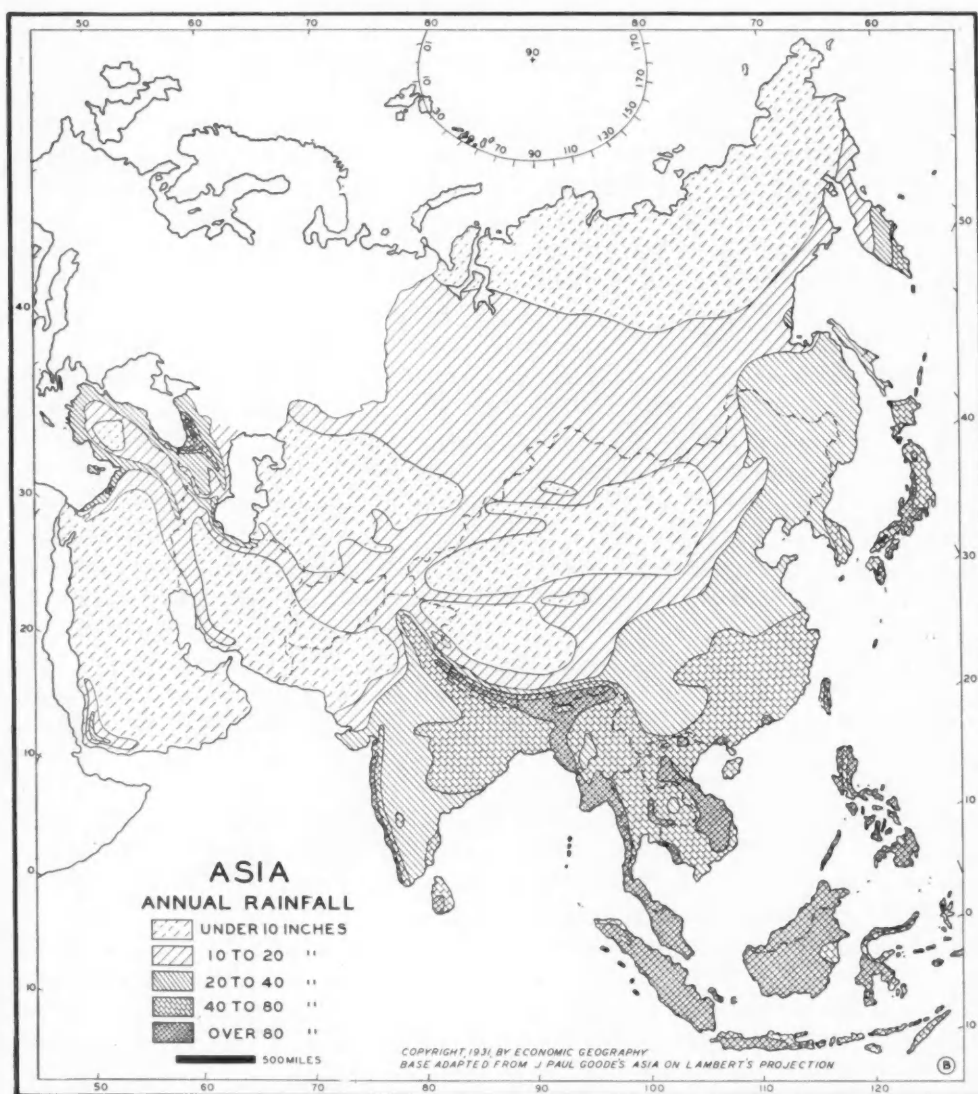


FIGURE 2.—Only a relatively small part of Asia's vast area is well watered. Fully four-fifths of the continent must be content with less than 20 inches annually, and almost or quite one-third must suffer with less than 10 inches. Only the great monsoon-swept lands are blessed with rainfall adequate and trustworthy enough for crop production without irrigation. Small areas in the Near East are likewise blessed with sufficient rainfall for satisfactory crop production. Any great expansion of Asiatic agriculture or intensive land use would seem impossible. The habitable lands of Asia have long been fully occupied.

blocks approached most closely. In the East, the structure of the Himalaya-Tibetan system becomes even more complicated, for there the primitive blocks became themselves involved in the movement, and all three elements—primitive northern

block, primitive southern block, and Tethys sediments, enter into the structure of the world's greatest mountain system.

The northern block, containing the original nuclei and the peneplaned Caledonian and Hercynian folds col-



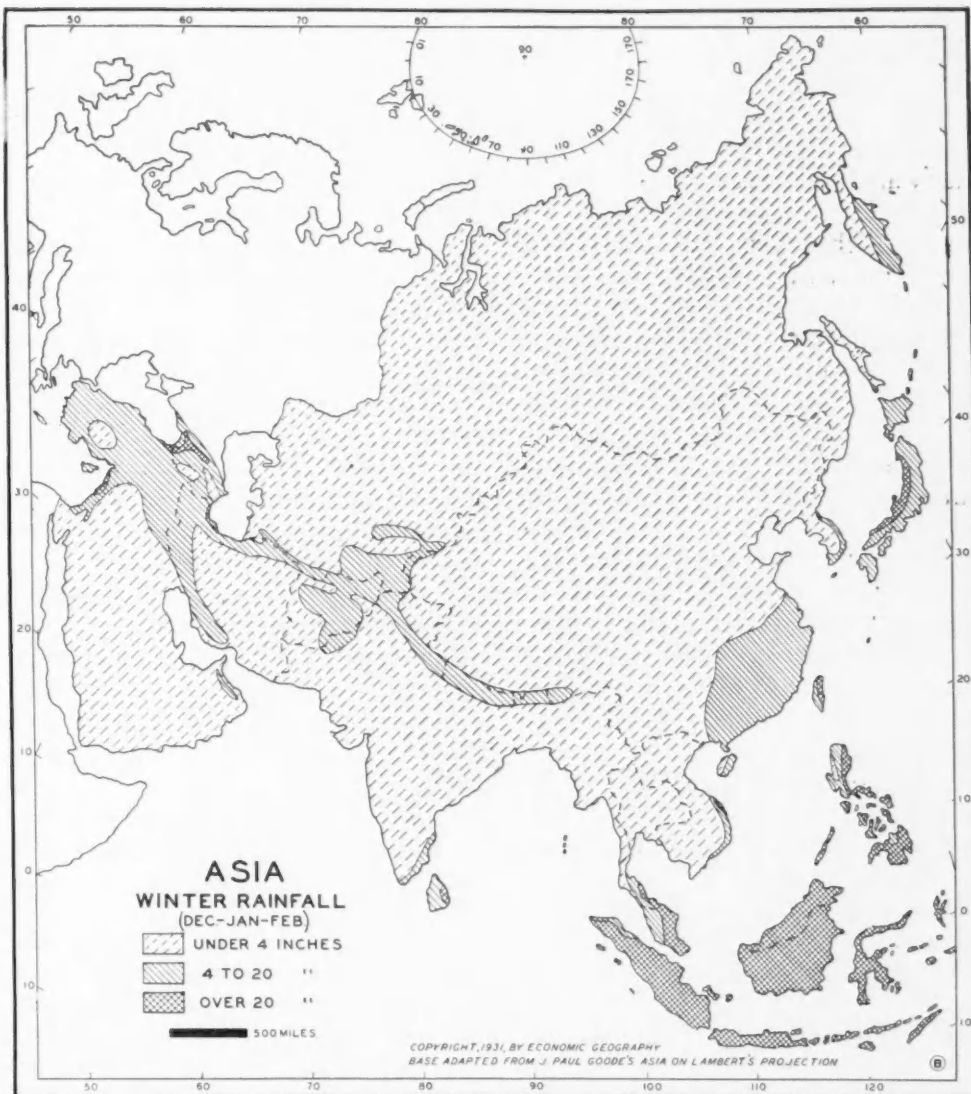


FIGURE 3.—The winter precipitation—for the months December, January, and February—is startlingly slight for the continent of Asia as a whole. The extent of the Mediterranean type from Asia Minor to the foot of the Himalayas, and the distribution of the eastern littoral precipitation for winter is clearly significant in the character of the vegetation and land use of these areas. In connection with Figure 2, this map most emphatically indicates the widespread aridity over the world's largest land mass.

lapsed under the tremendous pressure of the Alpine structural movements along the lines of least resistance; the earlier mountain axes and the present relief is more or less a repetition or reflection of the still earlier, renewed but containing old geologic materials. The transition from the new alpine

to the "renewed" section of Asiatic relief, lies generally north of Tibet, where the ranges radiating from the Pamir, constitute the *new* Alpine, and the more northerly ranges rising from the Turanian Basin (the Tianshan, the Altai, and the Sayan) constitute the *renewed* ranges.

And what is now the physiographic interpretation of this series of geologic processes?

1. The *new* Alpine regions, on the whole, may be expected to be, as many are, of high relief and elevation, and to express youthful activity in forms with steep gradients, little adaptable to human land use; yet the long time through which the Alpine movement took place and the long intermissions between movements permitted the development of mature, even old, land forms, modified by later disturbance, warping and uplift but nevertheless recognizable in the subduing and softening of youthful ruggedness. The high Himalayas attained their present altitude only in comparatively recent geologic time; they reveal many evidences of former much lower levels of erosion, in the seemingly illogical, inexplicable drainage systems.

2. The *renewed* ranges may be expected to show—as they do—a tendency to diminish in altitude toward the north away from the axes of pressure; but since this lower elevation is offset by higher latitude, it produces little effect on human use of the land. Traces of a former peneplain are common and widespread, and the high mountain section in many places exhibits softly rounded contours. The different cycles of uplift caused different levels of erosion; in the Gobi desert, particularly, different levels of peneplanation are apparent in the warped surface of the peneplain.<sup>4</sup> Though the ancient structure of the Tamir Basin forms a true basin, the others are not really basins but are filled as a result of warping by structural ranges and blocks.

<sup>4</sup> Berkey and Morris, "Basin Structures in Mongolia." Bulletin American Museum of Natural History, Vol. LI, pp. 103-127, 1924.

In the well-watered, slightly uplifted, but geologically old, section of China, man met less difficulty in winning his living from the land, and the relatively dense population of the Southern Uplands, of Shantung and Shensi, of Southern Chosen, and some Manchurian upland indicates that there man has conquered the Asiatic mountain systems, without achieving economic sovereignty, such as he exercises on the plains.

3. The longitudinal coastal valleys lying between the ranges in southeastern and eastern Asia with the alluvial deltas of their great rivers, open and exposed to the monsoons laden with moisture in summer, and adapted to irrigation are areas of maximum crop production and population; the valley of the Yangtse is one of the world's most densely concentrated areas of population, rivaled only by the Indo-Gangetic plain.

4. The circum-Pacific mountains, especially the outer ranges, show evidences of constant geologic action and youth. Volcanoes crown most of the ranges, and earthquakes are frequent on the eastern edge toward the deep oceanic abysses. Only some of the interior ranges of Borneo indicate greater age. The coastal plains of these mountain systems are limited in area, but most possess fertile soil and warm, moist, salubrious climate that have promoted high density of population, as in sections of Java, Luzon, and Japan.

#### THE PLATEAUS

A high steep escarpment rims the plateau of Arabia on its western and southern border. The plateau dips generally toward the east, interrupted only by the Central Arabian Mountains. The western edge is

complicated by the continuation of the Great Rift Valley which extends southward far into Africa, and northward from the Red Sea and the Gulf of Akaba through the Dead Sea and the Jordan Valley into Syria where it encounters the Alpine ranges of Asia Minor and northern Mesopotamia. The Oman Ranges of older Alpine origin do not belong geologically to the plateau.

Escarpmnts also rim the Deccan on both the east and the west, being more continuous and pronounced on the latter margin (Western Ghats), more broken and subdued on the former (Eastern Ghats). The interior is bowl-shaped, with easterly drainage. The plateau extends northwestward toward the Punjab, and northeastward across the Ganges as the Assam Hills, the two extensions originating the corresponding "knots" of the Alpine ranges—the Pamir and Upper Burma.

The Central Siberian plateau is a rather low dissected upland. Of minor extent and importance, the Turgai plateau between the Ural and Kirghiz mountains might be continued into the Ust-Urt plateau between the Caspian Sea and Lake Aral, were not the elevation below 500 feet.

#### THE PLAINS

Besides the river plains already mentioned between the mountain ranges, Asia presents two great lowland sections, one south of the Alpine ranges between the ranges and the plateaus of Arabia and the Deccan; and the other extending from Turan northward to the Arctic, and divided by the Turgai plateau into the southern Turan basin and the northern West Siberian lowlands. The latter are a continuation of the Russian

plain of Europe from which they are separated by the Ural Mountains with their old physiographic forms.

The lowlands south of the Alpine ranges comprise the Mesopotamian syncline north of the Arabian plateau and the Indo-Gangetic syncline north of the Deccan. In the latter the great river systems—the Indus, the Ganges, and the Brahmaputra—arising in the bordering high mountains have deposited vast quantities of alluvial material; because the divide between the Ganges is only a little over 500 feet above sea-level the two basins may be considered continuous and are so indicated on the map; the former, the Mesopotamian syncline, is occupied by the alluvial plains of the lower Tigris and Euphrates, and by the Persian Gulf.

#### CONCLUSION

On the whole, Asia is composed largely of mountains and plateaus, with comparatively small areas of lowland. Unfavorable climate restricts crop productivity of most of the plateaus and many of the lowlands, and concentrates human use of the land, as it does population, upon a few fertile, well-watered lowlands, which by virtue of their favorable qualities compensate for the lack of advantages in the rest of Asia's great extent, and sustain the world's greatest centers of population.

#### CLIMATE

Three major factors dominate the Asiatic climate: (1) the locational extent of Asia from the Equator (Singapore is  $1\frac{1}{2}$  degrees north of the Equator) to beyond the Arctic Circle (Cape Chelyuskin is within 13 degrees of the North Pole); (2) the relief with its great mountain ranges enclosing great interior basins; and



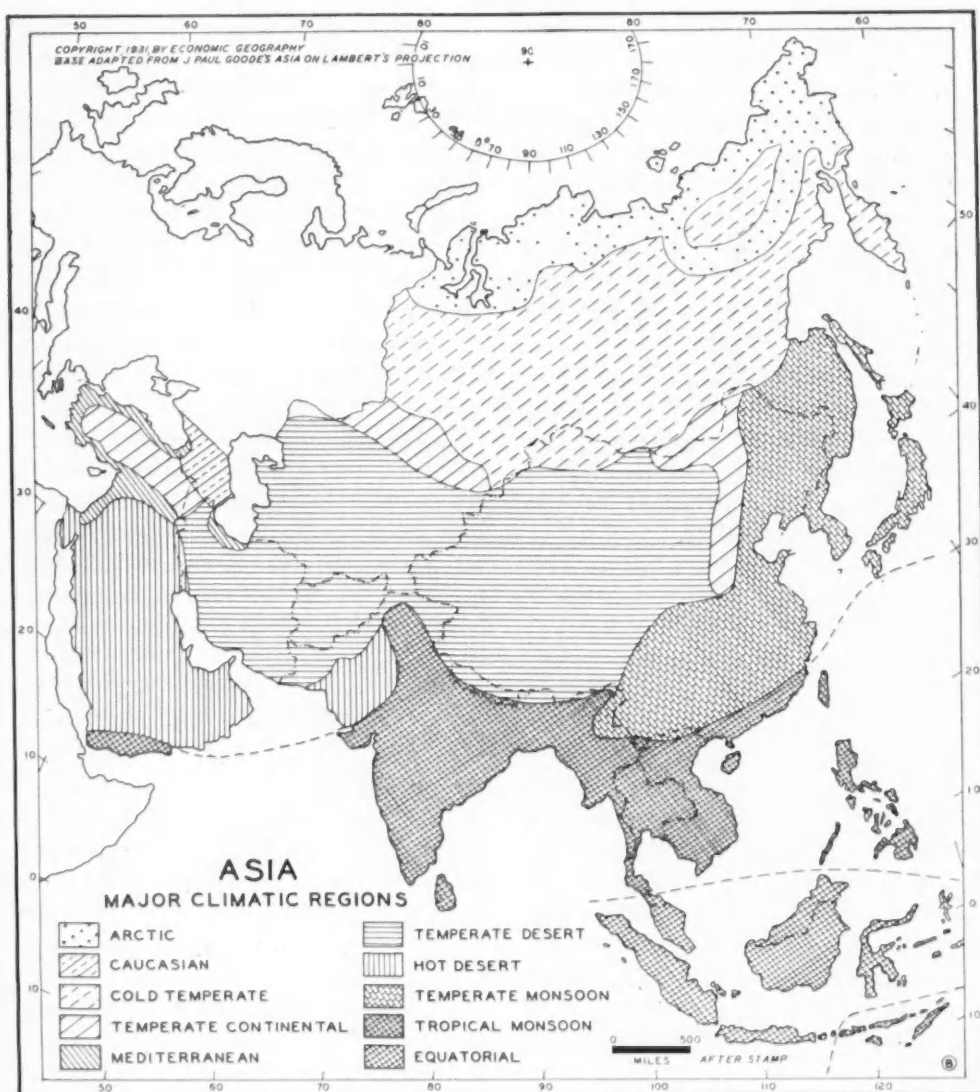


FIGURE 4.—L. Dudley Stamp's climatic divisions lend themselves so practically to the discussion of crop distribution and land utilization in Asia, that they are accepted well-nigh unmodified for this map. The ten divisions are almost self-explanatory to any student of Asia's geography. They reveal the close connection of the types of climate with the location, area, form, and relief of the continent, and with the distribution and activities of the people.

(3) its great area, whereby even without any modification by relief, oceanic influences lose themselves long before the center of the continent is affected.

Of these three major factors, area is probably most important, and makes Asia a land mass unit almost

independent of the regular climatic belts paralleling the Equator, a land mass constituting a continental unit from which the winds blow out from a cooling interior to a relatively warm sea in winter and blow in from the relatively cool sea to a rapidly heating interior in summer—a system of

continental land- and sea-breezes, not on a daily régime, but on a yearly schedule, called the *monsoon*. The monsoon, somewhat dominated by relief and certain local influences, regiments the entire Asiatic climate except in the Near East; a study of Asiatic climate thus becomes a study of the monsoon and its local modifications and effects, as illustrated in the two maps—one of yearly rainfall and one of winter (December, January, and February) rainfall—accompanying the following discussion.

In compiling the rainfall maps of Asia, I have used besides older sources the following material, all relatively recent:

1. General                      World weather records, Smithsonian Institution, Washington, 1928.  
Erwin Ekhart: *Eine neue Regen Karte der Erde*.  
Petermann's *Mitteilungen*, 1930, Heft 3 and 4 (of special value for Siberia).
2. Japan                        The Rainfall of Japan, 1911–1920 and 1921–1925, Central Meteorological Observatory, Tokio, 1927.
3. Manchuria                Land Utilization Maps of Manchuria by Nobuo Murakoshi and Glenn T. Trewartha, Fig. 4, *The Geographical Review*, July, 1930.
4. China (includes        E. Gherzi: *Etude sur la pluie en Chine*, Shanghai, 1928. (Extract, A. J. Henry, *Monthly Weather Review*, January, 1929.)  
Taiwan and  
Chosen)
5. Malay Archipelago    J. Boerema, *Rainfall Types in the Netherlands Indies*, 1925.
6. French Indo-China    J. Sion, *Asie des Moussons*, Fig. 76, Armand Colin, Paris, 1929.
7. Siam                      W. Credner, *Grundzüge einer Gliederung Siam in seine Teillandschaften*, *Geographische Zeitschrift*, 1930, Heft 4 and 5.
8. Burma                    L. Dudley Stamp, *An Undeveloped Monsoon Country*, *The Geographical Review*, January, 1930.
9. Near East                R. Blanchard, *Asie Occidentale*, Figs. 5, 11, and 27.

#### THE ASIATIC WINTER

Unaffected by any warm air from the south, because of the barrier

which the long, east-west extension of the Alpine mountain system forms, central and northern Asia cool intensively in winter. A widespread cushion of heavy air centers over the Gobi Desert and extends northeastward over Siberia and to a lesser degree westward over the inner basins of western Asia. From this high-pressure cushion, the winds blow out of the interior of the continent toward the peripheral borders and the warmer oceans. The strong, cold, dry winds cause an almost total absence of economic activity in all phases of land utilization except in areas protected by mountain walls, like southeastern Chosen and eastern

Hondo, which contrast strongly with the windswept, windward shores.

In India and Indo-China south of the Alpine mountain system and in

China south of the Tsinling range, the winds blow from the land to the sea, and are dry, but they have no connection with the cold interior cushion, because of the intervening mountain system, and thus they are not cold like the winds of northern and northeastern Asia. The 40° F. isotherm in January intersects southern Hondo, extends south of the Yangtse delta (which is influenced by the cold northeast winds despite its southern location) toward the Tsinling mountains. In northern India the average January temperature remains above 50° F.

When the winds blowing out from the cold high-pressure interior pass over seas and are then forced to rise over mountains, they cause winter precipitation, as, for example, on the west coast of Hondo, where the westerly monsoon, having crossed the sea of Japan, and having taken up a great deal of moisture from the warm coastal waters of a branch of the Kuro Siwo current, produces heavy rainfall.

Heavy rain also falls on the eastern side of some of the island festoons or mainland borders as the winter monsoon shifts toward the Equator into a northeast wind, not different from the regular northeast trade winds. Thus, the northeast coast of Taiwan and the east side of the Philippine Islands have a distinct winter rainy season (See Fig. 3, Map of Winter Rainfall); likewise, the east coasts of the Malay Peninsula and of Ceylon are watered by winter rain. The winter rainfall, or better, the fall rainfall, of southeast India and Annam is more properly an extension of the summer rainfall, resulting from local cyclonic storms, especially frequent in November.

The Mediterranean shores of west-

ern Asia fall in the belt of cyclonic storms with their frequent westerly winds. Toward the north, rare depressions invade the land and bring some precipitation into Siberia; toward the south, where the Mediterranean type of climate with its regular winter rain is restricted to the coastal section, weak lows from the Mediterranean Sea, affected by the Black and Caspian Seas, sweep far inland, and produce typical winter rainfall for all the Near East Mountains along the Mesopotamian syncline as far as Oman, and farther eastward into Afghanistan, even continuing along the south slope of the Himalaya Mountains. The winter precipitation is of utmost importance for the Near East with its dry summers; in northern India, it provides the moisture necessary for winter crops.

Winter rain also falls in southern China, southern Japan, and along the eastern coasts of the Japanese islands. Occasional lows wander out from the basin of Szechuan and also from farther south and farther north, eastward toward the Aleutian low, and cause inflowing winds from the ocean with precipitation. Sometimes a vagrant typhoon sweeps northward along the Japanese coasts, and changes the regular winter monsoon conditions.

Attracted by the continental summer low of Australia, the northeast winds blowing out from Asia, south of the Equator, shift toward the northwest. Laden with moisture, these west-monsoons bring heavy rains over the whole southern part of the Malay Archipelago, except for a few sections in the wind shadow (for example, southeastern Celebes). On the Equator, where winds are generally light, orographic barriers cause



regular heavy precipitation with thunderstorms.

The winter rainfall on the eastern coast of Kamchatka is produced by the northeast wind circling the Aleutian depression southeast of the peninsula.

#### THE ASIATIC SUMMER

Summer climatic conditions may be said to be just the opposite of the winter climatic conditions. The heated continent produces a low-pressure area over most of the inte-

length of the rainy season from south to north.

Relief features produce wide local variations. Where mountains extend at right angles to the in-blowing winds, like the western Ghats of the Deccan and the mountains of western Burma and the Malay Peninsula, rainfall is exceptionally heavy. Where the winds blow into a funnel-shaped or re-entrant mountain angle like Assam about Tcherapunji, the highest rainfall of Asia is produced. On the other hand, where mountains



FIGURE 5.—The Kirghiz steppes constitute one of the widest expanses of pastoral nomadism in the world. Their fertile soils have been for ages unutilized for crop production because of the low and untrustworthy precipitation; upon their sparse but nutritious vegetation the nomad peoples who have wandered over them down the long course of central Asia's history have pastured their herds and flocks. (Courtesy of Ginn and Co.)

rior, centering on the Indian desert toward which the winds blow from the seas into the land mass. As they come from the surrounding oceans and are forced to rise by elevations bordering the coasts, they produce heavy rain. Summer monsoon rain falls all the way from India to the eastern coast of Siberia, varying only in quantity (most in the south and least in the north), and in decreasing

enclose basins and bar the rain-bringing winds, as on the Deccan and the east coast of the Deccan, Central Burma, the east coast of Malay Peninsula, and Indo-China, the summer rainfall is correspondingly much diminished.

Rain also falls in northern Asia (Siberia) where the westerly winds carry enough moisture from the Atlantic to make crop production pos-

sible. The northerly winds on the Arctic Tundra are desiccating, because they blow from the frozen Arctic Ocean toward a warm, rather low continental terrain.

The interior basins remain arid, because they are far from the beneficent moisture of the coasts and are shielded from any invading moist winds by their enveloping high mountains. The dry zone, of which the interior basins constitute the larger part, is continued westward into the Near East, where the northerly winds blow anti-clockwise about the low pressure area of the Indian Desert—only the southern coasts of the Black and Caspian Seas receive from these winds summer rain. The Yemen uplands of southwestern Arabia receive a continuation of the Abyssinian summer rains, of which traces persist along the coastal mountains of the Hadramaut.

South of the Equator the East-monsoons blow from the Australian continental winter high. Originating as dry winds, they increase in humidity toward the west and yield some mountain rain during the dry season of the southern Malay islands. Where mountain barriers protect areas from the monsoon, as in north-western Java, considerable rain may fall locally.

#### CLIMATIC DIVISIONS

(Consult Figure 4)

Although Köppen's system defines most scientifically the climatic regions, L. Dudley Stamp's climatic divisions have so many practical advantages that except for a few minor alterations, they are accepted for this map in their entirety. The ten divisions are the following:

1. *Equatorial Climate*.—The parts

of Asia and the Malay Archipelago that lie near the Equator (from 5° N. to 5° S.) fall within this division. Temperatures are high the year round with very little seasonal variation. Rainfall is heavy in all seasons, though a wet and a dry season can be distinguished in many places. On the eastern Sunda islands, the dry season becomes so distinct that they cannot be included with this division. The transitions in fall and spring between the dry season and the wet season have the highest temperatures, and from the human point of view are least comfortable.

2. *Tropical Monsoon Climate*.—India, except the dry west portion, southeastern Asia, the Philippine Islands, southeastern China, and Formosa constitute this division. The difference between the dry and wet seasons becomes very pronounced; the rainy season begins in May–June and ends in September–October. The temperatures begin to show clear seasonal variations. The cool season with little rain from November to late February is followed by the hot dry season from February to June, when the summer rain begins and the temperature falls. Toward the north winter temperatures during the cool season fall as low as 60° F. in Hongkong.

3. *Temperate Monsoon Climate*.—The dry winter and the rainy summer continue the typical feature of the temperate monsoon climate as of the tropical monsoon climate, but the rainy season becomes briefer toward the north and the amount of precipitation decreases. Summer temperatures continue rather high as in northern Manchuria where it attains 70° F. for July—but the winter temperatures are strongly affected by the cold winds from the interior and fall



FIGURE 6.—Rafts of tropical hardwoods, including the incomparable teak, are floated down the Menam river, from the dense, deciduous monsoon forests of Indo-China. (Courtesy of Ginn and Co.)

to 40° F. in southern China and below 0° F. in northern Manchuria. The climate of Japan is typically marine, and might well have been considered as a separate division.

4. *Hot Desert Climate*.—The hot desert section of the Near East extends into India. The rainfall is very low with a winter maximum, except in some sections bordering the monsoon divisions. The temperature in winter rarely falls below 50° F.

5. *Temperate Desert Climate*.—In the great Asiatic basins, summer temperatures are very high except when ameliorated by altitude. Winter temperatures are nearly everywhere very low. Aridity distinguishes the division.

6. *Mediterranean Climate*.—This type of climate dominates the Mediterranean coasts of western Asia and the southern side of the Alpine system in places extending over northern Mesopotamia. Like the corresponding climate of southern Europe, the winters are mild and rainy, and the summers, warm and dry. Features of this climate extend throughout the Near East.

#### 7. *Temperate Continental Climate*.

—The steppes of Asia Minor, southwestern Siberia, and eastern Mongolia, which comprise this division, are watered by from 10 to 20 inches of rain, which falls solely in summer. Temperatures are cool to warm in summer, but invariably cold in winter.

#### 8. *Cold Temperature Climate*.—

Enormous seasonal differences in temperature characterize this division—long, very cold, dry winters and short, rather hot summers with light rainfall.

9. *Arctic Climate*.—Extreme cold during most of the year distinguishes this division along the Arctic Ocean and the high eastern Siberian mountains. A short, but rather warm, summer with twenty-four-hour sunlight for a brief period interrupts the long, dark, very cold winter. The subsoil always remains frozen.

10. *Caucasian Climate*.—The Caucasian division is added to include the complex and localized climates of the Caucasus Mountains and their basins.

### THE MAP

The vast extent and varied relief of Asia preclude the practicability,

even the possibility, of dividing its area into a system of individual agricultural divisions as so successfully employed by O. E. Baker in his "Agricultural Regions of North America" and Clarence F. Jones in the "Agricultural Regions of South America." In describing the "Agricultural Regions of Europe," Olof Jonasson faced the same difficulty of complexity and intricacy which constitutes so serious a problem in discussing the land utilization of Asia, where the difficulty is even greater. To prepare a map simple enough for general use, which presents the essential facts and available data, necessitates limiting the divisions to show only major systems of land utilization and the discussions to crop production principally, with some corresponding measure of detail in the maps.

In accordance with that principle, the map presents the following divisions:

1. Tundra and Alpine
2. Desert
3. Forest
4. Grazing
5. Crop Land—with four divisions; wheat, rice, millet-sorghum, and oats
6. Plantations
7. Oasis

By this simplicity of major divisions, the main types of land utilization may be readily distinguished, and by combining the several legends, diversified types can be indicated. A general review of the map precedes the detailed sectional discussion.

#### TUNDRA AND ALPINE

The great belt of tundra extends along the whole coast of the Arctic, and where the terrain is higher, far southward along the elevations. It

is an area of ever-frozen subsoil, and a surface soil frozen and snow-covered nine months of the year and swampy and boggy the rest of the year through the short summer. The heavy layer of mosses and lichens affords food for some Arctic animals even in winter, and for large numbers during the few summer months. The primitive nomadic tribes rear a few reindeer, just as they do on the tundra of northern Europe, but on the whole, the tundra is agriculturally unproductive.

Similar conditions control agricultural activity on the high western section of the Tibetan plateau, where aridity adds its unfavorable influence to that of persistent low temperature. On this vast, high plateau, only the numerous lakes break the monotony of stony desert wastes; but here and there, scanty grass suffices to provide pasturage during the summer for some stock like sheep and yaks.

Glaciers and snow fields cover the upper parts of the high Asiatic mountains, the lower limit of snow and ice depending on the latitude and the amount of precipitation. Between the glaciers and the ice fields in protected vales and parks, alpine meadows, resplendent with brilliant flowers in summer, provide food for the stock which the nomadic residents of the lower slopes or the surrounding grasslands bring seasonally to pasture on the rich, nutritious grasses of the high alps. None of these alpine pasture grounds are significantly productive, and their period of usefulness endures only through the short summer.

#### THE DESERT

Unproductivity, consequent upon lack of precipitation, characterizes the great Asiatic desert zone in all its forms from the sandy hills of the



Ruba El-Khali in southern Arabia (only recently traversed for the first time) through the interior basins of Iran and Seistan, Turan and Tarim, up to the rocky surface of the Gobi. After periods of showers, the desert is covered with green grass and flowers, when it affords slight pasturage to the flocks from the neighboring steppes; but this transient vegetation

taiga of Siberia, a nearly virgin reserve of unexploited softwood resources, extending across the whole extent of the continent, and in a slightly different form southward over the high mountains of central Asia; the gray maqui of the Mediterranean climate, dead in summer but gorgeous with blossoms in winter; the temperate mixed hardwood and



FIGURE 7.—Grazing is probably the most widespread of all the types of land utilization in Asia. This view of a Persian river valley, the only place where trees of any size grow in the country, illustrates the part that water plays in a nomad's life. Transhumance is well developed in Persia. (Courtesy of Ginn and Co.)

disappears as quickly as it comes, and leaves the desert lifeless and monotonous, parched by the blazing sun in summer, swept by blizzards in the winter.

#### THE FOREST

The Asiatic forests present exceeding diversity and variety from the economic point of view as well as from the botanical standpoint. The

coniferous forests of the Caucasus and the northern Far East, reminiscent of central Europe; the semitropical forests of Japan and China with their varied flora and semi-subtropical appearance (bamboos, for instance); the dense equatorial rain forests with their great variety of hardwoods; the deciduous monsoon forests of India and Indo-China in which teak is the outstanding eco-

nomic feature; and finally, the tropical acacia scrub of portions of the Deccan and the Korat plateau of Indo-China—all these, in their great variety and diversity, afford an equally great diversity and variety in economic use and importance.

In southeastern Asia particularly, but also farther northward, even as far as Chosen, primitive types of people use the forests in a nomadic system of agriculture (milpa or ladang), by which dry crops, like mountain rice in the south, or millet and oats in the north, are grown on the land after the forest is destroyed by fire, and open areas are occupied by the crops; as soon as the open spaces have been harvested, they are abandoned and revert to forest.

#### GRAZING

The land utilization of the Near East and the Interior Basins is best exemplified by the grazing herds which wander over the steppes and semi-deserts, followed by their nomadic shepherds with their families, all searching for the food which the niggardly land doles out to them so sparsely. The boundaries of the grazing areas are indefinite. On the one side, crops intrude slowly but surely into the grasslands, as in Manchuria and on the Kirghiz steppes; on the other side, the desert encroaches. In times of occasional rain, the grazing hordes invade the desert, and dominate it until the last blade of grass is gone; in times of drought, the deserts spread their dry arms and seize most of the grasslands. Grazing also characterizes the slopes of the central Asiatic mountains between the arid belt and the snow-line, wherever forests permit. Penck<sup>5</sup>

estimated a breadth of 3,000 feet for this grazing zone along the Tibet massif, increasing to 7,000 feet farther north on the northern slope of the Tian Shan.

Though the character of the herds varies with the temperature belts, they generally comprise sheep, goats, and camels, combined with yaks on the high steppes of Central Asia, taurine cattle on the Kirghiz steppes, and horses in Arabia. In the dry monsoon section of Indo-China, Brahman cattle and buffalo constitute the grazing herds.

#### ZONES OF OASES

Interrupted chains of oases, in places restricted to river outlets, stretch along the lower slopes of most of the higher ranges of the Interior Basins. They border the mountains north and south of the Kura Valley in Transcaucasia; the mountains of Iran and Seistan wherever greater altitude produces more rainfall, and small streams deploy upon the mountain foot; and the hilly piedmonts that fringe the basins of Tarim and southern Mongolia. Where the amount of water for irrigation provided by the mountains is abundant, for example, from the melting glaciers and snow fields of the high central massif, an extensive oasis complex is formed, like that which sustains Yarkand, Kashgar, Khotan, and Aksu.

Whereas the type of agriculture is everywhere the same throughout the zones of oases, the products differ according to temperature conditions; everywhere they form green islands of fruit trees under which cereals, like wheat, barley, and maize, and in places even rice, tobacco, cotton, or opium, are grown. The narrow zones of irrigated oases along the rivers are included with this division, like the

<sup>5</sup> Albrecht Penck, *Central Asia*, *Geographical Journal*, Vol. LXXVI, page 477, 1930.



FIGURE 8.—Rice is the dominant crop of equatorial and subtropical monsoon Asia, and the principal food of the people. On all the lowlands of the continent, from India to northern Japan, where rainfall is adequate, rice culture is characteristic and always associated with some form of irrigation. This scene from an Annam rice field is typical. (Courtesy of Ginn and Co.)

strips of cultivated crops along the Hoang-Ho west of the Ordos plateau and similar strips along the Helمند river in Seistan and the Murghab river in Russian Turkestan, because their area is too small to be distinguished as separate crop areas as was done for the larger irrigated tracts along the Euphrates and the Tigris, the Indus, and the Amu and Syrdarja. In Arabia, dates take the place of the more Mediterranean type of fruit trees, grown in the oases of the basins. Oman forms another fringing zone of oases as does Dhofar with its glorious coconut trees, irrigated from the steep slope of the southern edge of the plateau, but Hadramaut is a complex of oases, watered by the precipitation collected in the Wadi Hadramaut system. Of the multiplicity of oases in central Arabia, the map depicts four: the Jebel Shammar zone; the Wadi Rumah zone; the Riyadh area—all these three watered by the rainfall on the high central mountains—and near

the Persian Gulf, the Hasa zone watered by a line of ground-water springs.

#### WHEAT

Wheat originated in a land of little rain, probably from the Near East; hence, it is not surprising that it constitutes still the main cereal crop of the Mediterranean areas of winter rainfall. As this rainfall coincides with the cool season, the two essential factors for the successful growth of wheat—moderate rainfall and rather cool temperatures—are provided. Consequently, wheat dominates the crop lands in all sections of the Near East, where rainfall exceeds 10 inches and where irrigation is adequate, and fields of wheat flourish along the Mediterranean shorelines between groves of citrus trees, figs, and olive trees, competing only with tobacco (about Smyrna) and with cotton (Cilician Plain). Where the rainfall sinks below 10 inches, barley takes the place of wheat in the crop régime.

The plateau of Transjordan and Upper Mesopotamia; the Inner Basins of Asia Minor and Armenia, where wheat rivals grazing in significance; and the mountain valleys of the Zagros system; all these produce wheat. On the irrigated river plains of Lower Mesopotamia, wheat remains the dominant winter crop, but rice replaces it in summer; in economic value and significance, dates surpass both. The high plateau of Yemen produces wheat as the main cereal crop, because the cool temperature of the high altitudes and the summer rain are peculiarly favorable; but the terraced slopes below produce the famous Mocha coffee. Wheat is also important as a winter crop in northern India, partly on the irrigated fields of the Indus river system, partly along the foot of the mountains where the winter rains extend farthest east. In these areas, barley or millet replaces wheat in all drier localities. In the summer season, the Punjab wheat-growing section produces other crops, like cotton and sugar cane.

Wheat as a summer crop is the conspicuous cereal of northern Asia. It is grown on the irrigated fields of Russian Turkestan and northward along the foot of the mountains where cotton accompanies it as an important crop. Though most important, wheat must share the crop acreage of the Black Soil Belt of western Siberia between the taiga and the dry Kirghiz steppe with other cereals like rye and oats, with barley, and in the north with dairying. Wheat continues, with millet, the principal cereal crop in northern China, and also in northern Manchuria, though in the latter, the acreage of soy beans equals the combined area of wheat and millet. In Japan, wheat is grown

as a winter crop wherever the mild climate permits, but, compared with rice, is of secondary importance.

#### RICE

Rice is the dominant crop of equatorial and subtropical monsoon Asia. It is always associated with some form of irrigation, even in regions of heavy rainfall, and on all the lowlands from India to northern Japan, where rainfall is adequate, rice fields distinguish the landscape. The rice crop climbs up the slopes of the great equatorial volcanoes of the Malay Peninsula and the Philippine Islands, replacing the equatorial forest; it displaces other crops from some of the irrigated fields of the dry Near East—the southern Indus plain and Lower Mesopotamia. The great densities of population of the Ganges-Brahmaputra plain, of the Deccan coastal zone, of Java and Luzon, of the coastal plain of Indo-China and southern China, and of the Japanese Islands depend upon rice for their origin and sustenance; and where the population is less concentrated, rice is exported as from the three great rice harbors of the great southeastern river plains—Rangoon, Bangkok, and Saigon-Cholon.

Wherever growing conditions are favorable, rice is the main crop, but other secondary crops deserve mention. On the tropical lowlands, coconuts thrive, and constitute a crop of paramount importance to the natives—as on the coast of the Malabar, of Ceylon, of Java, and of some of the Philippine Islands, as typical examples. On the lower Ganges-Brahmaputra delta, jute is an important fiber crop, and supplies nine-tenths of the world's production. In the Philippine Islands, Abaca or Manila hemp constitutes a well-known fiber crop.



Maize is grown everywhere with rice if the rainfall is not unduly heavy, and it even replaces rice as the principal food crop on the dry eastern slope of the Malay Archipelago. Sugar cane (on the Ganges plain and in Luzon), tobacco (more or less everywhere, but important in northern Luzon), sweet potatoes, cassava,

coastal hills of China; cotton assumes importance on the Yangtse plain; and mulberry trees to feed the silk worms occupy spare land wherever silk is produced. In Japan, summer rice monopolizes the plains, leaving only the hills for such other crops as barley, tea, and mulberry trees. Where conditions are suitable, cereals like



FIGURE 9.—Soy beans and soy bean cakes lying on the docks at Dairen, Manchuria. Soy beans are such an important element in the crop system of Manchuria that the acreage devoted to their cultivation approaches that of wheat and millet combined. (Courtesy of Ginn and Co.)

ground nuts, and all kinds of fruit, of which the banana is the most important for food—all these are secondary crops in one part or another of the rice lands.

Though rice remains the staple food crop in China and Japan, wherever it can be grown, particularly in Japan, many other crops are given a share in the land use. The specialized intensive cultivation of China includes a number of intertilled crops. Tea is grown rather widely on the

barley and wheat are raised as secondary crops in winter.

#### OATS

Somewhat a misnomer for this division of land utilization, the term "oats" merely represents a series of crops which require similar conditions. In central and eastern Siberia, particularly along the Transsiberian railroad, oats replaces wheat as the main crop. In Hokkaido and northern Hondo, where conditions are similar,

peas, beans, and potatoes are more important than oats; in northern Hondo, oats becomes almost negligible, as it does in southern Hokkaido with its increasing acreage of rice. Barley, maize, buckwheat, and millet are also grown, but oats, nevertheless, remains the best representative for the whole zone.

#### MILLET AND SORGHUM

This crop of cereal grasses embraces a number of annual cereal and forage *graminae*,<sup>6</sup> grown principally in regions not adapted to wheat or rice, because of lack of rain, too high temperatures, or infertile soil. The sorghums (*Andropogon sorghum*) are a well-defined group, but the millets yield to no definite botanical definition. As a cereal crop, they dominate the land utilization of the Decan, central Burma, northern China, northern Chosen, and Manchuria, and form one of Asia's most important staple foods.

In India the millets and sorghums extend to the isohyet of 40 inches rainfall, thus including most of the plateau except where irrigation is applicable. Over this area they constitute the main cereal crop, and cotton the great textile crop. The latter is concentrated on the hinterland of Bombay east of the western Ghats and on parts of the Madras provinces, but even where it is most important, it does not occupy so much acreage as do the millets and sorghums.

Wheat is associated with millet, and in Manchuria with soy beans, in northern China and Manchuria. Soy beans are such an important element in the crop system of Manchuria that only because the combined acreage of wheat and millet is greater than that of soy beans, is a

division devoted to soy beans excluded from the map.

#### PLANTATIONS

Plantation, or estate, agriculture differs from other types of crop production in that it represents a highly organized, specialized production of one or more distinctive crops, cared for by native labor under the supervision of white managers, and capitalized by proprietary shareholders in the United States or Europe. In most cases a "factory" is involved, and the final product is intended for world trade and not the local market. Plantations characterize chiefly the colonial possessions of foreign powers, like India, the Malay Peninsula, the Malay Archipelago, the Philippine Islands, and Taiwan. The principal estate crops are:

1. Rubber—in the Malay States, Java, Sumatra, Ceylon, Sarawak, Siam, and Indo-China.
2. Tea—in Ceylon, Assam, southern India, Java, Sumatra, and Taiwan.
3. Sugar—in Java, the Philippines, and Taiwan.
4. Tobacco—in Sumatra, Java, and northern Borneo.
5. Coffee—in Java and Sumatra.
6. Fibers—in Sumatra, Java, and the Philippines.
7. Palm Oil—in Sumatra.
8. Coconut (Copra)—in Java, Sumatra, and the Philippines.
9. Quinine (Cinchona)—in Java and Ceylon.
10. Cacao—in Java and Ceylon.
11. Pepper, coca, cinnamon, and spices constitute other small plantation crops.

Between the regularly organized estate and the individual farm, a large number of transitional forms,

<sup>6</sup> Robbins, *Botany of Crop Plants*.



FIGURE 10.—Tapping trees for rubber on a Sumatra plantation. Plantation agriculture is distinctive in its one or more specialized crops, produced by native labor under supervision of foreign managers, and capitalized by foreign corporation interests. The product is generally intended for world trade, and not for local needs. (Courtesy of Ginn and Co.)

resembling one or the other, constitute a zone which renders it almost impossible to define the plantation divisions sharply.

Since the complexity of Asia's land utilization prevents detailed regional discussion of the agricultural units, the detailed description is applied by sections as follows:

1. The Near East, to include Asia Minor, the Caucasus, Ar-

menia, Syria, Palestine, Arabia, Mesopotamia, Persia, and Afghanistan.

2. Monsoon Asia, to include India, southeastern Asia with the Malay Islands and the Philippines, and the Far East (China, Japan, and Chosen).
3. Russian Asia, to include Turkestan and Siberia.
4. Central Asia.

## THE GEOGRAPHY OF CHOSEN

*J. Wright Baylor*

**C**HOSEN, the long-sought prize of China, Japan, and Russia, is a peninsula extending southward from Manchuria nearly four hundred miles to divide the Japan and the Yellow Seas (Fig. 1). Its northern extent to the Tumen River gives it a total length of six hundred and sixty miles. Thus, as a direct result of its location, extent, and peninsular shape, the Hermit Kingdom for over five hundred years has been the subject of many disputes and controversies between countries struggling for the supremacy of the Far East.

Were Chosen superimposed upon the coast of Western United States, it would reach from Los Angeles to Crater Lake; moreover, its shape, except at the northern extremity, would closely approximate that of the state of California. Although Chosen has a total coastline of 1,950 miles, the eastern coast is devoid of any good harbors while the extreme high tides of the Yellow Sea have made it difficult to utilize the numerous inlets of the western coast for shipping.

Since the peninsula averages but one hundred twenty-five miles in width and has a mountain range extending the entire length (Fig. 2), it follows that there are no large navigable rivers. Nevertheless, there is considerable local commerce for a few miles inland on the Naktong, Han, and the Taidong Rivers; moreover, river navigation is carried on up the Yalu for over sixty miles (Fig. 1).

### CLIMATIC CHARACTERISTICS

Despite the fact that Korea lies in the latitude of California, her position on the leeward side of Asia results in a much more rigorous climate. The climates of Korea may be likened to those in this country from Virginia to Maine, although tempered somewhat by reason of the peninsular shape of the country and a decided summer monsoon. A study of its temperature reveals that Chosen's January average varies from 16° F. in the northern mountains to 37° in the southern lowland near Fusan. During the summer months the peninsula has but little variation of temperature from place to place.

The high humidity during the early summer rain season from April to July is a feature of the climate which is not agreeable to the average American or the North European. Cool, dry winters, the result of the northwest monsoon, are very conducive to energetic human activity.

The average annual rainfall of Chosen is 36 inches. The most humid areas, however, the southern part and the northeast tip, receive over 40 inches while the northwest portions receive but 25 inches of precipitation.

Jones and Whittlesey assign the Hermit Kingdom three climate types. North of Kanko on the east side of the mountains we find the modified humid continental with its characteristic heavy winter snowfall. This accounts for the fact that in northern



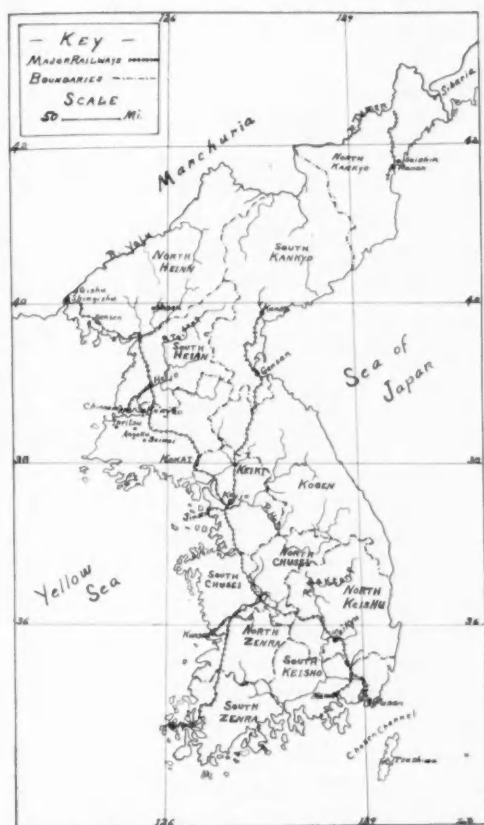


FIGURE 1.—Place map of Chosŏn. (From Report of Government General of Chosŏn, 1923.)

Chosŏn the total annual precipitation is heavy although the summer rains are much less than in the vicinity of Fusan. From Gensan and Seoul (Keijo) southward the climate is typically humid subtropical with a nine-months growing season and with sub-zero temperatures uncommon. This subtropical climate is further evidenced by the fact that at Fusan the date of first snowfall is not until December 25 and the last one March 7. The Taidong and the Yalu basins with the adjoining highland areas fall into the humid continental type since they are influenced by continental winds from North China and Manchuria. The small size of the arm of the Yellow Sea, together with the

mountain barrier to the east, results in a minimum of oceanic influence in the western part of the peninsula. The similarities of climate in most of Chosŏn may be gathered from the following table taken from the Japan Year Book of 1930:

	Fusan	Keijo	Gensan	Heijo
Days of rain . . . . .	107	113	119	104
First frost . . . . .	Nov. 10	Oct. 15	Oct. 23	Oct. 14
Last frost . . . . .	Mar. 25	Apr. 21	Apr. 14	Apr. 23
First snowfall . . . . .	Dec. 25	Nov. 17	Nov. 17	Nov. 16
Last snowfall . . . . .	Mar. 7	Mar. 27	Apr. 5	Mar. 28

### DOMINANCE OF AGRICULTURE

While the islands of the Malaysian coast were producing sea-roving pirate bands, the "thousand islands" of Chosŏn were not affecting the peaceful Korean agriculturists. Thus, contrary to the usual effect of insular position, Chosŏn has remained an agricultural nation. Nearly eighty-five per cent of the population depend directly upon agriculture de-

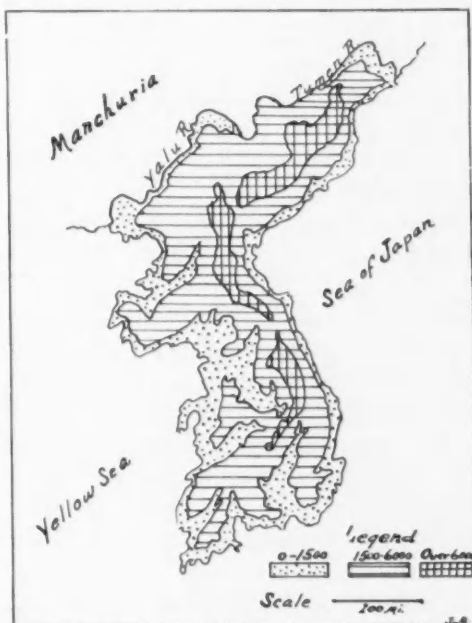


FIGURE 2.—Relief map, showing the mountain chain, the lower slopes, and the coastal lowlands. Note in particular the western basins and the break in the mountain barrier west of Gensan (Figure 1).

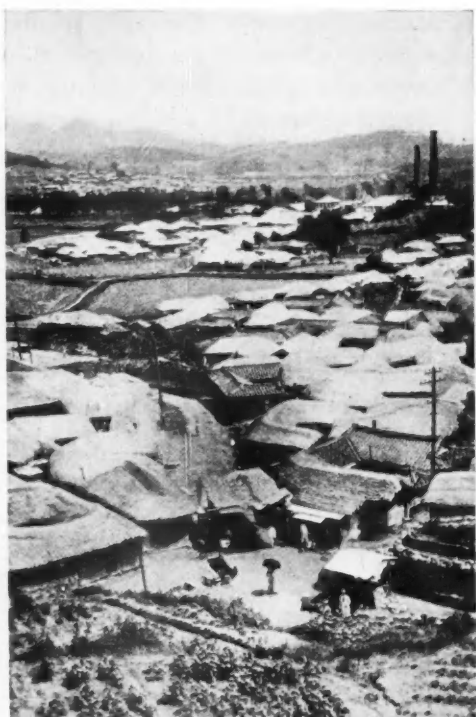


FIGURE 3.—A typical Korean village scene characterized by winding streets, open sewerage disposal ditches, clay or stone huts with thatched roofs.

spite the fact that there are extensive mineral deposits on the peninsula while the Japan and Yellow Seas, on either side, offer an excellent opportunity for development of the fishing industry.

The continued dominance of agriculture has probably been due to: (1) Relative isolation from the outside world because of a lack of land routes; (2) Absence of any highways within the country itself; (3) A very favorable agricultural climate, characterized by warm, humid summers and mild winters; (4) Extreme tides of 34.5 feet on the west coast which have made access difficult; (5) Poor harbors on the east coast coupled with the fact that there were no developed lands to the east or north, hence no necessity of commercial

development; and (6) Lack of land suited to agriculture on the narrow eastern fringe (Fig. 2) resulting in the most densely populated areas being on the west and south where the high tides made isolation complete (Fig. 11).

#### REGIONS OF CHOSŬN

A regional treatment of ChosŬn based on distinct differences within certain human use areas would be impossible. The factors which have been responsible for the dominance of agriculture, with the possible exception of internal isolation, have naturally resulted in a marked homogeneity of occupation on the part of the population. In fact, the dress, customs, and economic activities of the northern mountaineers are very similar to those of the residents of the southland. Hence, we do not find the greatest differences in mode of living resulting from climatic or other immediate environmental causes, but from differences in life within and outside the walled cities.

From the foregoing facts it can readily be seen that if any regional divisions are recognized, their boundaries must necessarily be indefinite. Such broad transition zones as exist may be likened to the zones of transition which occur where the Central States Corn Belt merges into the Winter Wheat and Spring Wheat Belts.

The Hermit Kingdom does, nevertheless, lend itself to a possible regional treatment based on the five following divisions (Fig. 4):

1. Central and Northern Mountain Region.
2. The Eastern Rim.
3. The Southeast Silk Area.
4. Western Agricultural Basins.
5. Northwest Mining Areas.

## CENTRAL AND NORTHERN MOUNTAIN REGION

Chosŏn has often been regarded merely as a mountainous projection from the mainland of Asia. Were one to travel from the heights of the Pai Shan, at the headwaters of the Yalu and Tumen Rivers (Fig. 2), down the backbone of the peninsula for four hundred miles, he would no doubt agree. The Pai Shan Mountains, whose peaks rise to 8,000 feet, are practically uninhabited (Fig. 11). Snow covers the main range from three to five months of the year. This, the home of the Korean tiger, is an area practically unknown to the white race since but few have dared penetrate the wilderness.

*The People, their Superstitions and Adjustments*

The natives are very superstitious; hence, usually refuse to act as guides. It is only with the military persuasion of Japanese gendarmes that it is possible to press them into such service. The northern Koreans are not only superstitious but also very curious of their white brothers. When the first American visited the upper Tumen basin, the natives suggested every imaginable method of testing the round eyes of the "pale stranger."

The typical home in northern Chosŏn is the two- or three-room clay hut with thatched roof and few windows (Fig. 3). The unique heating system consists of a wide flue running under the floor of the house. The chimney, made from a hollowed log, protrudes from the opposite side. This method of heating the home, which is very satisfactory even in the coldest weather, is also used in many other parts of the country as well.

In the lower mountain regions,

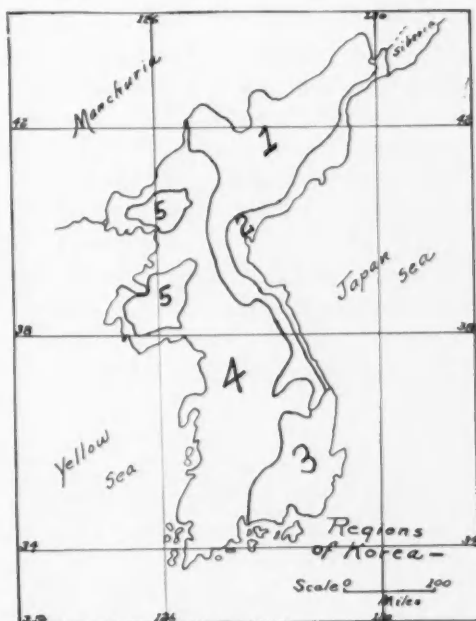


FIGURE 4.—Regional divisions of Chosŏn: (1) Central and Northern Mountain Region, (2) Eastern Rim, (3) Southeast Silk Area, (4) Western Agricultural Basins, and (5) Northwest Mining Areas.

patch agriculture of wheat, millet, and barley predominates, while in a few of the mountain valleys rice culture is attempted. It has not, however, been successful in this region.

As one proceeds southward, he is impressed with the extent and ruggedness of the Diamond Mountains near Gensan. With the decrease in latitude one notes the corresponding increase of the subtropical crops, the most notable being the increase of rice culture in the few mountain valleys. Due to the limited area which may be tilled, any extensive agricultural development is impossible.

Lumbering, as an industry in this region, is far below the rank that it should hold. Many of the more inaccessible peaks, together with the upper valleys of the Yalu and Tumen, are partially timbered while the barren foothill areas and the lower peaks present a problem of first magnitude

in reforestation. Total forest lands of Chosen amount to nearly 40,000,000 acres, but at the present time there are less than 14,000,000 acres of standing timber of any value.

Careless exploitation of the forests for centuries has made it necessary for the Government General not only to take steps to preserve the few areas remaining, but also to launch an extensive afforestation program. This has included the education of

little significance. The only important pulp or lumber mills are located at Gishu near the mouth of the Yalu River (Fig. 5). Here the Japanese and Chinese are engaged in relatively extensive lumbering operations, but only within the limits set by the Government General.

#### THE EASTERN RIM

The Eastern Rim region presents a varied assortment of occupations.



FIGURE 5.—Lumber rafts on the Yalu River. Timber which is cut in the winter is floated down the river in small rafts during the spring and summer rains. (Courtesy of South Manchuria Railway.)

the people in practical forestry as well as the establishment of numerous nurseries in every part of the country. It may also be noted that since there are seven hundred varieties of useful trees in Chosen, the peninsula is well suited for afforestation on the widest scale.

The several thousand square miles of timber of commercial importance is mainly larch. Alder and oak are found on many of the foothills and in some of the upper valleys, but are of

In spite of this, its isolation resulting from the mountain barrier directly to the west and its characteristic occupations justify its existence as a separate unit. It might be further sub-divided into a coastal strip and a narrow agricultural belt extending lengthwise at the base of the mountains, the former being characterized by fishing and marine interests and the latter by agricultural pursuits.

Since it is handicapped by its small area of tillable land, the East-



ern Rim has become a region of rice on the lowlands with barley, millet, and some sericulture on the higher lands. When one reaches Sam Chek, one hundred miles north of Fusan, he has passed from the area dominated by rice and silk to a narrow coastal fringe of mixed agriculture. True, we still find sericulture carried on, but we have left its major area. From Kanko northward there is a decrease in silk and rice production with a correspondingly increased acreage of wheat and barley. It is significant to note that, whereas barley in the southern part is a winter crop, being planted on the rice land after the rice harvest, it is here spring sown.

#### *The Fishing Industry*

The low tides and the abundance of fish along the shore have resulted in the "Fisher Folk" of Korea. There are numerous small villages along the coast which, from a distance appear beautiful, but are found upon investigation to be dirty and unattractive, and to possess no definite street pattern.

Primitive fishing methods and tiny boats formerly resulted in small catches. Despite the odor, the fish were dried on the beach in the sun, later to be shipped to other sections of the peninsula. Usually the fish were eaten raw, the only necessities being sufficient salt and spices to add to the flavor.

Government laws and regulations relative to fishing methods employed, tackle used, season, and the places where fishing is permitted, were adopted in 1912. Chinese have been forbidden to fish in Korean waters. The government program has included the establishment of fishing schools at Kunsan and Reisui, of

aquatic experiment stations, and of better market and harbor facilities.

With the introduction by the Japanese of modern methods and with the adoption of the government program, the industry has grown considerably. The previously mentioned primitive procedure of salting and drying the fish is being very rapidly replaced by modern methods and machinery in hopes of increasing the quality of the product to the extent that it will be able to compete successfully on foreign markets. As a result of this transformation that has taken place the value of fishing products has increased from less than four million dollars at the time of annexation to nearly thirty million dollars in 1927. The total value of prepared marine products in the same year amounted to over eighteen million dollars.

#### THE SOUTHEAST SILK AREA

The Naktong basin lands and the adjoining foothill areas are noted especially for rice and mulberry culture. The heavy rains in early summer afford sufficient moisture for rice with a minimum of irrigation, while the density of population and the subtropical climate tend to promote the silk industry.

The Japanese have introduced new varieties of the silk cocoon, a factor which has resulted in a great growth of the industry. For centuries Chosen had produced small quantities of silk but the quality was very poor; hence, sericulture had never flourished to the extent which the ideal environmental conditions would seem to justify. In fact, the Korean area is much better suited climatically than Japan since it has a much drier rearing season.

In 1910 there were only 7,600 families engaged in sericulture while the

output was but 70,000 bushels of cocoons. By 1921 the industry had grown so that 312,000 families were engaged in the industry and the production had increased ten-fold, while in 1929 the production had reached the enormous figure of over 2,000,000 bushels, an increase of twenty-eight fold in less than eighteen years.

It should be noted in this connection that by 1929, twenty-three filatures had been located in southern Chosen. The operation of them has resulted in a marked decrease of cocoon exports and an increase of raw silk export to Japan. The present high quality of the Korean product places it on a par with the best silk of Japan.

In addition to the success of mulberry culture in this area, the warm climate makes possible a two crop agricultural system wherein fall-sown barley or wheat is grown on the paddy rice lands. Thus, October is not only a month characterized by the rice harvest, but also the sowing of autumn wheat; moreover, correspondingly, June and early July are periods of wheat harvest as well as rice shoot transplanting. This two-crop agriculture makes possible the maintenance of a very dense population (Fig. 11). Although there is some cotton grown, it does not rank in importance with silk, but, rather, is typical of the next area of study.

The region is especially well located commercially, being but one hundred thirty-five miles from Japan, having a good harbor (Fig. 13) (Fusan), and possessing direct rail connections with the Western Basins. Due to these commercial advantages in addition to its climatic advantages, the Southeast Silk Area bids fair to become one of the leading silk-producing regions of the world.

#### THE WESTERN AGRICULTURAL BASINS

Because of location, size, production, and potentialities, the Western Agricultural Basins division is the preëminent geographic region of Chosen. For centuries the great Han Basin, radiating in three directions from the mouth of the river near Jinsen, has been the center of economic and political activity of the Hermit Kingdom.

The climate is ideal for agriculture and were it not for the short period of high humidity during the early summer rains, it would be as ideal for man. In spite of this, the absence of extreme temperature changes or conditions and the clear, cool winters make the climate generally favorable when considered from the standpoint of human activity.

Seoul (Keijo) may be classed as the dividing line of two-crop culture since north of the capital city, barley and wheat are spring sown while to the south the practice is similar to that of the Southeast Silk Area. South of Seoul rice is perhaps the outstanding product of the region, cotton being a close second. Rice culture is particularly adapted to the lowland areas and flood plains of the rivers. There is some upland rice, but cotton and the cereal crops have, to a large degree, limited rice to the flooded fields.

#### *The Government Program*

Formerly the acreage which could be used as paddy fields was limited because of poor irrigation facilities, but this difficulty has been partially overcome by the extensive irrigation works recently installed. Most noteworthy, however, is the entire agricultural program adopted by the government in 1925. The pro-

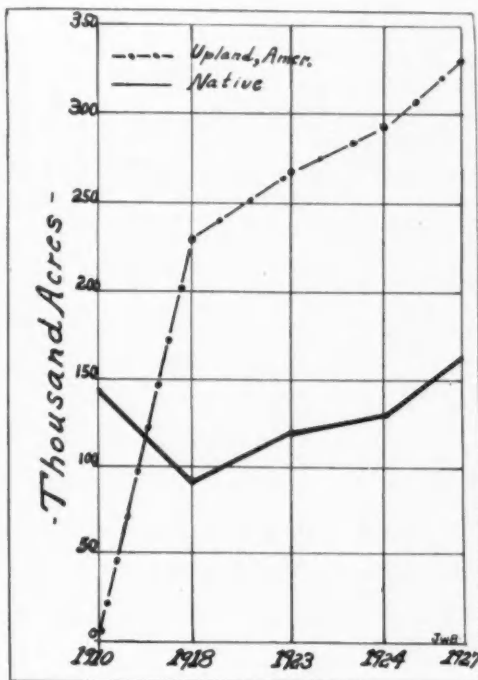


FIGURE 6.—The relative growth or decline of native and American Upland cotton acreage.

gram is to run for fourteen years, starting with 1926. Although the cost will be \$160,000,000, it is hoped that by increase of acreage and of reliability of irrigation, the rice production will be increased fifty per cent.

The urgent need for irrigation was evidenced in 1928 and 1929. After an excellent 1927 crop of 87,000,000 bushels, a dry June and July in 1928 resulted in a marked decrease of production. Similar difficulties were experienced again in 1929. Torrential rains during the harvest season in both years also added to the difficulties.

Chosen, in spite of its use of rice as a staple food, is now exporting (Fig. 12) large quantities of that cereal. Since the quality of the rice produced on the peninsula is very high, it is now successfully competing with the best grades of rice from Japan.

### *The Cotton Industry*

Cotton, a leading product of the region (Fig. 7), has made as great strides in the past decade as silk. For centuries it had been grown, but not until 1912, soon after the introduction of the American Upland varieties, did it enter into export trade. The American varieties seem best adapted to the southern part of the section. The area under upland cotton increased from 3,000 acres in 1910 to 231,000 acres in 1918. During this same period the native cotton acreage decreased considerable (Fig. 6). The great increase of the entire cotton production is perhaps best shown by the fact that by 1928 the total acreage and the yield per acre had increased so that there was a total of 227,100,000 pounds produced, an increase of 35 per cent over 1923. Of this, over seventy per cent was upland cotton and less than thirty per cent was of the native varieties. The climate of the major portion of the peninsula is very favorable for the growth of cotton. In addition to this, cheap labor is plentiful. In view of these facts, and the increasing demand for cotton in Japan's textile mills, it is probable that cotton will be one of the leading exports of Chosen in the future.

### *Other Agricultural Products*

Wheat has become increasingly important as a cereal crop on the peninsula. Although Keijo is the dividing line of the two-crop system, the climate is such in northern Korea that fall-sown wheat may be raised even in the lower Yalu valley. Nevertheless, despite the great increase in wheat acreage, Chosen does not as yet supply her own needs.

Besides being grown in the high-



FIGURE 7.—A typical cotton-picking scene in the Hermit Kingdom. This view also shows one of the few highways on the peninsula as well as telegraph lines. (From Report of Government General, 1923.)

lands to the south, soya beans, as well as wheat, are very important in the minor valleys of the northwest and the foothill country of the north central part of the region. The soya bean industry ranks a very poor second to rice in value of exports. Not only has the quality of the beans been largely responsible for the great increase in the industry, but the demand for bean cake for fertilizer by Japan has also aided materially.

Millet is grown in all parts of the Hermit Kingdom. In spite of this fact, it maintains its rank as a major import. It ranked far ahead of wheat and second only to cotton piece goods in the import list in 1928. This is largely a result of its being one of the major cereals consumed on the peninsula and of the limited acreage devoted to its growth. The 1928 crop amounted to only 26,000,000 bushels, or one-third as much as the total rice produced.

Tobacco is grown in every province; in fact, small tracts of it may be found on over three-fourths of the farms. Since it has been grown only for home use, it has not held an important place on the export list. Production, however, is on the increase and the high quality of Korean tobacco leaf has been of major importance in placing it on foreign markets in small quantities in recent years.

Gingseng, because of the high price it commands, is a valuable item of export. It is cultivated in several sections although the district near Kaisung is the most outstanding because of the extensive production and the high quality of the product. Gingseng is one of the state monopolies and its production is carefully controlled. Of the total production of 60,000 pounds in 1927, 50,000 went to China.

Stock raising, although as yet of





FIGURE 8.—Korean architecture. Note especially the roof shapes and the carvings.

minor importance, will undoubtedly develop rapidly in the near future. There are thousands of acres of excellent pasture land in the foothill areas and in the northern provinces. The climate is also very favorable. There is an excellent market near at hand in the Island Kingdom; moreover, the Japanese are already encouraging the industry and establishing packing plants.

#### THE NORTHWEST MINING AREAS

There are, enclosed within the Western Agricultural Basins region, two districts of especial significance because of recent extensive mining developments (Fig. 4). Valuable minerals are found in every part of the peninsula, while four of the provinces contain extensive deposits. For many years a few scattered gold, copper, iron, and coal mines had been worked, but it was not until after the introduction of modern machinery, investment of foreign capital, and supervision by expert engineers, that the great extent of the mineral deposits began to be realized.

Previous to the World War the returns had increased rapidly from three to twelve million dollars. The post-war depression resulted in the stopping of practically the entire iron and tungsten output; nevertheless, since 1924 the number of mining permits has again increased. At the present time there are over three hundred sixty mine lots being worked. Of this number, the gold, silver, iron, and coal mines constitute 80 per cent.

The Unsan-Changsung gold fields east of Gishu have been extensively developed. In 1924 a Korean discovered the Sansei mine near Sensen (Fig. 1) which has proven to be one of the leading gold producers. In 1929 its output amounted to \$3,500,000. In addition to these two major fields, numerous alluvial gold workings, most notably in the North Zenra Province, are making excellent progress. There is more gold produced in Chosen than in the remainder of the entire Japanese nation.

The iron industry has been recently marked by the opening of large modern smelters at Chinnampo and



Kenjiho. Both are centrally located in respect to the Heijo iron mines to the north and the extensive Inritsu, Angoku, and Sainei (Fig. 1) only thirty miles to the south. Limonite ores predominate except in the Angoku district where the ore is mainly hematite. Of the 1928 output of 500,000 tons, over one-third was

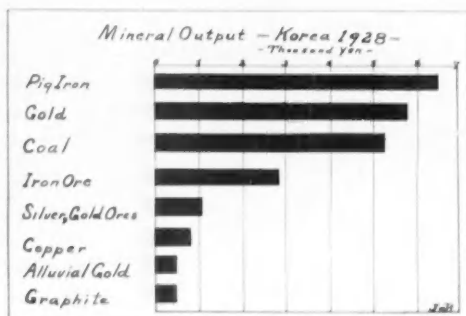


FIGURE 9.—The mineral output of Chosen for 1928, showing the predominance of iron, gold, and coal. (From Japan Yearbook figures for 1930.)

smelted by one Japanese concern at Kenjiho. The South Manchuria Railway is contemplating the establishment of a steel foundry near Gishu which will manufacture 480,000 tons of steel the first year and 570,000 tons each year thereafter. Production of sulphate of ammonia as a by-product is also being planned.

Coal has been, until recently, one of the major import items of Chosen. Korean railroads, which had previously depended upon Manchurian coal, are shifting to coal from the mines of the home country. Such a step will add greatly to the demand of coal from the local mines. At the present time the Heijo Colliery, a government enterprise, is working the only anthracite lots now being operated on the peninsula.

Recent estimates place the coal reserves of the country at 1.5 billion tons. Of this amount, 67 per cent is

hard coal, while the remaining 33 per cent is a poor grade of lignite. Tests are now being conducted relative to the possible use of lignite by the liquefaction process. The industry if established would be of such extent as to produce one million tons of gasoline and oils annually, moreover, would result in the opening of new lignite mines in the Kankyo provinces to meet requirements of the plant.

Aside from graphite, which is of very high quality, the remaining minerals of Chosen are relatively undeveloped.

#### THE PEOPLE

The peaceful agriculturists of the Hermit Kingdom stand out in sharp contrast to the impetuous Japanese. For centuries they have remained at home, unconcerned about the outside



FIGURE 10.—A modern charity hospital in the Hermit Kingdom. (From Report of Government General, 1923.)

world. These people, who bear little resemblance to either the Japanese or the Chinese, do possess a combination of racial characteristics of the Malays, Caucasians, and the Mongols.

Civilization within Chosen had several times, in centuries past, reached a much higher stage than that of 1900. In fact, the Japanese are forced to admit that the weaving

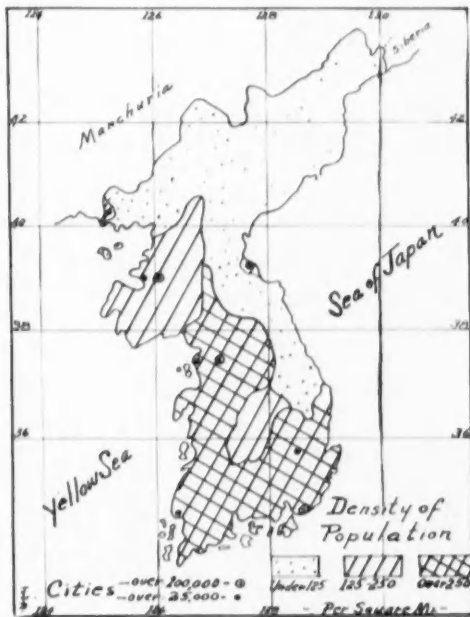


FIGURE 11.—Population map of Chosŏn. Compare with the relief and regions map. Note the concentration of the population in the Southeast Silk and the Western Basins regions.

of cloth, cultivation of the silkworm, printing of books, painting, and making of leather harness were all learned from the Koreans.

The industries of Chosŏn have long been characterized by guilds. These have resulted not only in excellent business coöperation, but also in mutual benefit associations, money lending syndicates, trading guilds, and even marriage and burial clubs.

Education, which is public, is not only encouraged by the government for its own sake, but is made the basis of promotion in government positions. In sharp contrast to the appointive practices in many leading nations, the Koreans have a regular civil service system wherein examinations are the basis of appointment to office.

The low moral standards of the Japanese are disgusting to the Korean, who, in spite of his filthy surroundings or personage, is of the

highest type morally. When one considers these facts relative to the temperament and customs of the inhabitants of the Hermit Kingdom, he can more easily understand why the complete transformation and so-called military régime attempted by Japan came as a shock to the quiet, peaceful agriculturists of the peninsula. In spite of the Japanese injustices and horrors inflicted on the Koreans after the annexation of Chosŏn, it seems probable that the inherent traits and the temperament of the Koreans will be largely responsible for the future stability and status of the country since "The potential genius of the present day Korean is awakening under the guiding influence of western culture and Christian Democracy."

#### MANUFACTURING IN THE HERMIT KINGDOM

Manufacturing, as an industry in the peninsula, is in its infancy. Despite the large cotton production in Chosŏn, there were but three mills in the entire country in 1929. Although the clothing of the Koreans for many decades has been made of white cotton fabrics, only one-third of the cloth now used is supplied by the homes and the factories. There are no finished goods being produced in Korea.

In spite of the present minor importance of cloth manufacturing, the establishment of new cotton mills at Masan and the great increase in number of filatures suggest that within a few years, manufacture, or partial manufacture, of textiles will be an important industry in Chosŏn. It is very interesting to note that 90 per cent of all crude textiles were produced in the homes as late as 1928.

The great demand for inexpensive

rubber shoes and sandals, not only in Chosen but also in North China and Manchuria, has resulted in the establishment of thirty-eight factories for their manufacture. The output is increasing rapidly as evidenced by the fact that the exports to Manchuria, alone, doubled in one year (1929). Naturally this great increase in rubber goods manufacture has resulted in a marked decrease of such products from Japan, who formerly furnished the entire supply. Although the sandals and shoes sell for but twenty to fifty cents a pair, the 1929 output was valued at four million dollars.

#### MANUFACTURES OF LESSER IMPORTANCE

Flour mills are unknown except for two small Japanese-owned concerns which supply only local demand. One sugar mill at Heijo, with a 1928 output of 25,100 tons, marked the extent of the sugar manufacturing industry. The raw material was imported from Taiwan, while the major portion of the finished product was exported to Manchuria. There is at present one large cement plant at Heijo that has been unable to supply the demand which has increased 20 per cent annually the past four years. The salt manufacturing industry has grown as rapidly as any industry on the peninsula. With the advent of Japanese supervision and capital, the output increased from 668 tons in 1910 to 65,000 tons in 1921. The last few years have also been marked by rapid expansion; nevertheless, Chosen must still import considerable salt each year.

#### COMMERCE

The commerce of Chosen, although considerable both in value and in

quantity, is practically limited to Japan and China. Perhaps most notable is the fact that in 1929, Japan took over 90 per cent of all exports and supplied 75 per cent of the

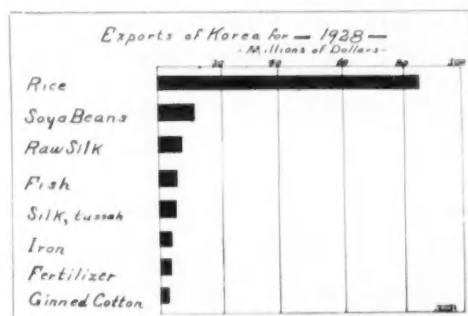


FIGURE 12.—Exports of Korea for 1928. (From Japan Yearbook, 1930.)

imports. Manchurian trade accounted for the remainder, with the exception of 8 per cent of the imports and less than one per cent of the exports.

As a result of her rapidly increasing industrial development, Japan takes 95 per cent of raw materials or partially prepared products, and supplies in return textiles, sugar, cement, and iron manufactures and steel goods. China (Manchuria to a large extent) imports from Chosen considerable sugar, lumber, and red gingseng, at the same time exporting to the peninsula, millet, coal, bean cake for fertilizer, lumber, and tussah silk (for re-export to Japan) (Fig. 12).

Of the small number of products imported by Chosen from the United States, gasoline, kerosene, tobacco leaf, and machinery account for the major portion of the 3.5 million dollars in direct trade. To this may be added products valued at 1.4 million dollars from indirect trade through Japanese ports. The United States obtains a small quantity of graphite and some Manchurian furs (re-ex-

ported through Chosŏn) from the peninsula.

#### SUMMARY

The peaceful agriculturists in the "Land of Morning Calm" have had thrust upon them, within the last two decades, modern civilization and the beginning of an industrial program, largely as a result of the increasing pressure of population in Japan.

In spite of their extreme militaristic régime, the Japanese have done good

risen to high rank, while Japan has also established over one hundred nursery stations to aid in carrying on the extensive reforestation program. The Japanese are responsible for a great increase of the fishing industry as well as marked improvement and stimulation in manufacturing, commerce, and agricultural conditions in all parts of the peninsula.

The most apparent needs or problems of Chosŏn include: (1) Development of a good road system; (2) Better



FIGURE 13.—A modern harbor scene at Fusan, characterized by the great number of Koreans working on the docks. Machinery is rapidly supplanting hand labor here, nevertheless. Note also the two large freighters in the harbor.

work, as is clearly revealed in the improvement in living conditions, introduction of modern methods of industry, and ten-fold increase of exports within fifteen years.

With aid of foreign capital and supervision, the mining industry has been firmly established and is rapidly developing. With Japanese supervision and research, sericulture has

living conditions, especially sanitation; (3) Continued reforestation; (4) Additional irrigation facilities; (5) A definite conservation program to prevent unnecessary exploitation of the minerals or the remaining forests; (6) Expansion of the educational system to meet the new problems and conditions arising from the increase of industrialism.

## THE MISSISSIPPI RIVER—ASSET OR LIABILITY

*William H. Haas*

OUR lack of mastery over the Mississippi and our seeming inability to cope with its many problems must seem strange to the foreign observer who imagines us as an economically efficient and aggressive people. The world over, rivers have been almost the first to yield to the demands of man; yet, this mighty stream, in spite of all our efforts at subjugation and the millions spent to make it subservient, is still untamed and its sovereignty undisputed. This is all the more strange since the interest in its control is not only regional but national. The recurring flood disasters are almost unparalleled in similarly highly developed regions and touch the economic as well as the humanitarian side of the whole nation. Likewise, the whole mid-West is handicapped by the lack of a reasonably cheap outlet to the sea, and the influence of a great internal system of commercial waterway might radically change our whole economic structure. Nevertheless, the stream still is little used and its flood waters are still a menace to an economic development crowding upon it.

The economic geographer, from the very nature of the case, is interested in the removal of handicaps that hinder the free play of productive forces in a region. Of course, for such improvements to be feasible, the results obtained must be commensurate with the expenditures made. In other words, the development of the Mississippi must be

looked upon as an investment that is reasonably sure to yield adequate returns. Naturally, such returns cannot be estimated wholly in dollar values since indirect effects may be more important than the obvious results. Nevertheless, the moneys appropriated out of the national treasury cannot be considered as a philanthropic gesture of good will to the mid-West nor as a political palliative for favors received or expected. As an investment such appropriations also must look forward to a permanent solution of the problem or problems. Unless this is done, we cannot be assured that this mighty waterway will not become a growing national liability, instead of a great regional asset.

Measured by the past, the future does not look particularly promising. A strict accounting of all past expenditures on the Mississippi to make it navigable, would, we fear, show results distinctly in the red. This does not mean necessarily that the moneys appropriated have been unwisely or lavishly expended. On the other hand, it may and probably does mean that the task set has been an impossible one from the standpoint of adequate returns and that there are too many other handicaps to overcome before the mere maintenance of a nine, fifteen, or thirty foot channel can make of it a great commercial highway. With flood control the situation seems on a somewhat different basis. Although the control of flood waters has been by no means a success, yet the cost of



building and maintaining levees has been borne chiefly by local taxes and contributions, and it is fair to assume that the expenditures seemed worth while locally or else the people would not have continued to assess themselves.

To appreciate fully the present situation a certain background must be had in mind. The very marked success of the Mississippi steamboat in the thirties and forties set a precedent which at present seems hard to live down. Since the steamboat on

of realization, there should be no delay in its realization. The politician, looking for political provenance, however, is not interested in the probability that for every six cents saved for the farmer in freight rates, it may cost the taxpayer at large two or three times that amount. Because of this political aspect of the question, we may expect with a reasonable certainty that in the near future increasingly large "raids" will be made on the national treasury without even considering the



FIGURE 1.—Sinking a willow mattress for bank protection on the lower Mississippi River, near Deer Park, Louisiana, 245 miles above New Orleans. The mattress is constructed of willows, which are woven and held together with cables. Rock is placed on the completed mattress, which is sunk when sufficient weight is piled upon it. This method of bank protection prevents caving, for the mattress is held in place by cables attached to permanent points on the bank. (Courtesy of Mississippi River Commission.)

the Mississippi once meant so much in the development of the region, so the argument runs, why cannot it be made to do so once more? Also, lack of a water outlet severely handicaps this rich inland empire; therefore, develop all the possible internal waterways, build others if necessary, and thus add six cents to the farmer's profit for every bushel of wheat he sells. This proves a very effective political argument and was indulged in freely during the late presidential campaign. The political picture as painted is rosy indeed and if possible

question of adequate returns for the moneys expended.

The demands for making the Mississippi a navigable stream have been with us for a long time. As early as 1879 Congress, after a number of seemingly futile years of effort, undertook in earnest the task of permanently locating and deepening the channel with a view "to improve and give safety and ease to the navigation thereof," by appointing the Mississippi River Commission "to mature a plan or plans" to this end. The first appropriation made under

the new act in 1881 very clearly stipulated that "no portion of the sum hereby appropriated shall be used for repair or construction of levees for the purpose of preventing injury to lands by overflow or for any purpose whatever, except as a means of deepening and improving the channel of the river."<sup>1</sup> These restrictions were placed on the use of funds because improvement in navigation was interpreted as a national problem, flood control a local or sectional one. As a result there

methods. At first each individual plantation owner did what he could to protect his own crops, and to strengthen existing natural levees was about all he could do. Shortly, plantation owners began to combine their efforts and from these unions there evolved the present levee districts, more or less political in character. To such bodies levee building was the only salvation, especially so since the Army Engineer also took to levee building in order to narrow the channel for the purpose of deep-



FIGURE 2.—Placing a concrete mat in position on the bank of the Mississippi River at Sunnyside, Arkansas, to prevent slipping and caving of the bank. (Courtesy of Mississippi River Commission.)

has arisen a strange sort of dual but ineffective control. National funds under the control of the United States Army have been used in an attempt to make the river navigable; local funds, raised as best they might, have been the basis for flood control work. Nature, of course, makes no such sharp distinctions and the system was doomed to failure from the beginning.

With flood prevention considered a purely local problem, there was little choice as to flood fighting

ening the water by increasing scour. Maj. Gen. Lytle Brown, Chief of Engineers, United States Army, in his "Flood Control Work on the Mississippi" states that "The federal government's activities in levee building were first induced by the belief that to confine the flood waters to the channel would increase its depth and so improve its low-water condition as regards navigation. In the long run that belief may be correct, though men may have to wait over a long period before the results become very apparent."

<sup>1</sup> *World's Work*, Vol. XXX (1915), p. 236.



FIGURE 3.—Completed section of paving and slab work along the bank of the Mississippi at Reelfoot Lake, Tennessee, showing how effective it is in preventing slipping and erosion of the bank. (Courtesy of Mississippi River Commission.)

Thus, out of this dual evolution there has risen what has become known as the "levee only" policy. This policy more or less completely under the control of the United States Army Engineer has dominated the situation for fifty years.

It is not surprising that with such a system of management and lack of unified control, the results are not what legitimately might be expected from the funds invested. Any large business concern, no matter in what line, run upon the same basis, could not have survived the period. To gather the necessary basic data and to organize them for an effective future under such a system has also been impossible. As has been well said, the results are about such as though the plans had come from a convention of river pilots. In an editorial which appeared in the December, 1927, issue of *Mining and Metallurgy*, the following appeared: "All the previous firm pronouncements of the Army Engineers as to cost and adequacy of levee system through fifty years have been proved wrong. . . . Someone has said that

our plans for Mississippi improvement are about such as might be evolved from a convention of river pilots." It states further "that less than one-third the area involved is covered by serviceable topographic maps; that the gaps in knowledge from stream gaging are almost as large as the area between; that the carrying and depositing power of streams is still a matter of sharp divergence of opinion under specific conditions, the fundamental studies begun by the late G. K. Gilbert of the Geological Survey at the University of California, having been left incomplete. Finally, nothing but a hurried and scanty study of spillways can have been possible since the maps necessary for a real study have not been made." This is quite in contrast to the serious study by the British Government which has found it profitable to appropriate a half million dollars annually solely for a study of the "Hydrophysics of the Nile."

The results of such a system of control are now becoming evident. New flood stages overtop all those



FIGURE 4.—The Government maintains many paving stations along the course of the Mississippi, continuously building protective banks to control flood waters. This one is at Barfield, Arkansas. (Courtesy of Mississippi River Commission.)

gone before as the drainage waters of forty-one per cent of continental United States, or 1,240,000 square miles, are concentrated by levees upon a narrow, shifting bed of alluvium between Cairo and the sea. In pre-levee days all flood waters spread out over a valley six hundred miles long and some fifty miles wide, the natural flow bed in time of flood. Progressively this flood plain has been contracted from fifty miles wide to less than one mile, from about 30,000 to 1,000 square miles. This contraction has been done, it must be remembered, not so much to reclaim flood lands as for the sake of aiding navigation. Thus, a seriously attempted control for fifty years has helped navigation little if any and has intensified the flood problem greatly. Stuart C. Godfrey, in his "Improvement of Navigation in Relation to Flood Control," states that "Indeed, navigation on the Mississippi does not lack encouraging developments. The present volume of this navigation is not generally ap-

preciated. On March 21, 1926, the *Sprague* finished a 300-mile tow to Baton Rouge with a cargo of petroleum (224,000 bbl. of crude oil) contained in nineteen steel barges. It would have taken about thirty of the old-time packet boats to carry this one cargo. No wonder that the rivers do not appear so busy in this era of barges and tow-boats! Yet the Secretary of War was able to state in his annual report for 1926 that the tonnage now handled on the Mississippi River System is twice what it was in the 'good old days' of river steam boating."

The reasons for the increasing height of flood stages are not hard to find. With the concentration of flood waters into this restricted area, there has been also a concentration of shifting alluvium. Sediments that once were distributed over 30,000 square miles of territory are now deposited on less than a thousand, or become an added load for already overburdened waters. The Army Engineer is proud of his record

in preventing cut-offs and thus avoiding even a brief delay in shipping; yet, this is Nature's way of increasing the gradient by decreasing the length of the stream course. Moreover, the Army Engineer builds dikes within the stream channel to shift the waters during low stages to the deeper part of the meander channel. This not only places an obstruction within the channel, but it also has a tendency to lengthen the meander with a consequent decrease in gradient. Narrowing the channel in the passes by jetties unquestionably aids in keeping the channel open, but it restricts as surely the passage of the waters with consequent effects. It also has a tendency to restrict the deposition of the alluvium at the mouth of the open passes, thus extending the mouth of the river into the Gulf about 300 feet annually, much more rapidly than it otherwise would. The inevitable result, therefore, of a policy that aims to keep the channel open to shipping at all hazards must be that levees to continue effective must be built higher and higher. Governor-elect Pinchot aptly has designated the policy followed as "suicidal" and Mississippi floods as "man-made disasters."

It has become very evident that along the path thus far traveled there can be no permanent solution. To aggravate an already serious situation and then grope about for correctives is not a sound policy. In the flood districts the banks of the river are approximately forty feet above low water. During flood stages the water rises from forty to seventy feet above low water, thus covering the restricted flood plain twenty-five or thirty feet. As the levees in general have been built up from twenty to twenty-five feet

above the present flood plain, abnormally high waters are sure to top them. Ordinary flood heights are adequately taken care of, but it is the occasional super-flood stage that is catastrophic and cannot be controlled by levees.

The "levee only" policy so tenaciously adhered to for so many years was based on several misconceptions. As has been seen, levees were built, in large part, and maintained under the assumption that they aided in keeping the river open to navigation. Fifty years have not proved that this is so. The levees also were built up to a certain height because it was assumed that that height would control any flood. This has been proved wrong, for revision after revision has had to be made to allow for the increasing heights the flood waters have reached. This increasing height was inevitable so long as the stream course was gradually narrowed by obstructions, and lengthened by the methods employed.

The "levee only" system has failed also because there is a definite limit both structurally and economically to levee building. Structurally, there is a limit because of the character of the base upon which the levee is to be built, and also because of the nature of the local material to be used. Obviously the levee must be built upon existing foundations and by the material present, whether sand, silt, or clay. To prepare a good structural base and bring in high-grade levee material from a distance, is entirely out of the question because of the cost. Thus, a levee on building may not be strong enough to support its own weight, or the foundations under the built levee may give way with a consequent ris-



ing of the land nearby. It is the extra foot or two placed on the top which may cause the whole to weaken. With additional height the water pressure and the consequent seepage is also tremendously increased.

Economically there is also a limit, no matter how valuable the agricultural lands to the rear. With a surface slope of one in ten, a thirty-foot levee with a three-hundred-foot base and a ten-foot top is a costly affair. Moreover, levees in general are short lived, averaging

were started originally not so much to protect developed lands to the rear as to improve navigation. When built, however, they gave value to the swamp and overflow lands ceded by the national government to the states in 1850. These lands now in private hands pay taxes and the states naturally as well as the owners are loud in their clamors for national protection whether the lands are worth the cost of protection or not. Thus, the lands, which national expenditures have helped to



FIGURE 5.—A view of the lower Yazoo levee district near Greenville, Mississippi, showing sand bags at left placed around a sand boll to produce back pressure by impounding water over it. Sacks to the right were placed over a sloughing slope on a foundation of brush. (Courtesy of Mississippi River Commission.)

about twenty years, and therefore the cost of building, plus the upkeep and heavy depreciation, about five per cent of cost per year, place a burden on the land valuations to the rear which are, in many cases, out of all proportion to their productive capacities. Since the cost of levee building increases as the square or even cube of the height, the land values must increase proportionately to stand the increased cost of building. A strange situation exists in many sections. In these the levees

create, as time goes on become an increasing liability to the creator.

If, therefore, the policy of making the channel navigable for large vessels and the valley flood proof against the highest of abnormal waters has proved a failure, then recourse must be had to other means than the levee. The only hope for ultimate success lies in the study of the river as a whole, and not merely in the consideration of the problems of navigation at the expense of all other factors. If anything is to be considered more

fundamental than others, it is the care of flood waters. In general this problem may be attacked from two angles. One is to take care of the extra waters before they reach the levee-restricted area. This attempts to slow up the waters until the danger is past. The other is to care for the waters more effectively after they have reached the leveed part. Each course is set with many special difficulties and serious deficiencies.

The problem, however, has been

storm reaches the upper Ohio Valley, the streams below have risen decidedly and when to the already high stage there is added the waters of the upper Ohio and of its prolific tributaries, abnormally high waters in the leveed section are the inevitable result.

In the matter of slowing up the waters before they reach the main channel, forest cover naturally plays an important part. As is well known, forests have a tendency to equalize

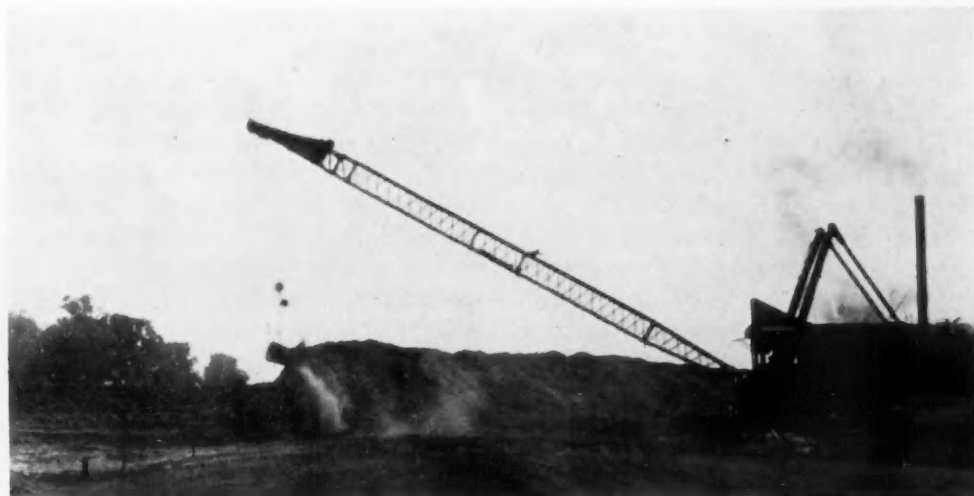


FIGURE 6.—Enlargement along the south bank of the Arkansas River, where almost 400,000 yards of material were moved by dragline. Such control work as this is necessarily continuous along the Mississippi and its tributaries to prevent disasters from flood. (Courtesy of Mississippi River Commission.)

simplified in some respects and complicated in others by the recent investigations as to the source of the critical waters that push over the top when the river is already in the flood stage. It has been found that such waters do not come from the upper basin, but are the product of a low, "the southwestern," or of a series of such lows that originate in Mexico or in our southwest, move through Texas, and pass up the Ohio Valley. The moisture supply is virtually unlimited and by the time the

stream flow by modifying run-off. Forests do this in a number of ways, chief of which is through the control of erosion. When the forest litter and finer soil particles are gone, tiny channels of run-off, which rapidly carry the water into larger streamlets below, develop. It is, therefore, not only a question of forest cover, but the nature of ground cover developed. From the limited studies made it is extremely doubtful, however, that any feasible reforestation project would have more than a very

minor effect on lower valley flood waters. Forests do have a regulatory influence, but floods in the lower Mississippi produced by exceptional meteorological coincidences cannot be controlled by any amount of reforestation in the upper basin.

Likewise, the storage reservoir in the upper basin offers little or no hope. After a preliminary study by a competent board, it has been shown that those already in existence, even those in the Miami Conservancy District, exert relatively little control. Built, however, with a view for storage and local purposes as well, a reservoir may justify its existence. Yet, in general, where such services are combined, the separate interests are quite commonly opposed to each other. The conclusion seems to be that the building of storage reservoirs in conjunction with local interest may prove profitable, but no projects thus far outlined for the control of floods alone warrant the expenditures necessary.

If there seem to be no effective methods of slowing up the waters in the upper basin, then the waters somehow must be taken care of below; and if the present system of levee building has broken down, then some other method must be worked out. Levees have been fairly successful makeshifts and may still have their place, but in no wise can they be looked upon as providing a permanent solution. The test for any new or untried method should be the reasonable assurance that it will prove not only a temporary success but will be also a permanent solution, and also that the benefits received will not be perpetually on the debit side relative to the sums invested. Perhaps this is too much to hope for, as relatively little effort is being made

to collect the basic facts necessary to make such a decision.

The problem of maintaining a navigable stream channel cannot be divorced from that of flood control. The two are too closely interrelated to do this, especially when alleviatory measures applied to the one add to the trials of the other. Since neither restrictions placed within the channel nor levees placed upon the flood plain have been successful in making the stream course a great waterway or the valley floodproof, the problem must be studied from a new angle. Of course the Army Engineer has never contracted to make the Mississippi a great internal waterway. He has set out to maintain a nine-foot channel and in this he has been on the whole successful. It is extremely doubtful, however, if a channel of much greater depth can be permanently maintained. The Chicago Sanitary and Ship Canal and the huge locks now being completed at Lockport, Illinois, however, are prepared for an ultimate twenty-three-foot channel in the lower Mississippi. The question naturally comes if this depth is ever attempted, as it probably will be, can it make of the Mississippi a regional asset or will it become more than ever a national liability?

The present is a critical period. The old order has broken down and a new policy is being established. What that new policy will be is not known to the layman, perhaps it is unknown to those in charge. Since the basic data necessary for proper evaluations of the many factors to be considered are not available, it would seem that only tentative policies can be worked out now. The main object should be to gather basic data to determine whether this or that



FIGURE 7.—The "Auburn to Douglas" enlargement on the south bank of the Arkansas River, where almost half a million cubic yards of dirt were moved by dragline to build up the levee for flood protection and control. (Courtesy of Mississippi River Commission.)

policy is workable in the light of all the problems, and also to see whether the one to be adopted is economically sound. Above all, the whole alluvial plain should be mapped topographically in the greatest detail, for here the solution of the problem must be looked for.

A brief summary of major possibilities, disregarding entirely their practicability, may be of value. One possibility is to divert the superflood waters through controlled, well-aproned spillways into leveed channels, protected against excessive erosion. This, however, among other things, would induce sedimentation immediately below the spillway in the main channel. Another is to set back part or all of the existing levees a mile or more, thus adding a thousand square miles or so to the existing flow and storage area. This would be of immeasurably more help than storage reservoirs at the headwaters of various streams. Still another possibility is to straighten the main channel in whole or part and thus speed up the waters. The flow distance if desirable could thus be reduced by one-half and the gradi-

ent doubled. Another course of action would be to remove channel obstructions placed to aid navigation, and permit natural cut-offs forcing the water by the placing of other obstructions to straighten its own course. This, however, would undo much of past effort to make the stream navigable. There is also the possibility of reorganizing the economic life of the flood plain on the basis that floods are inevitable, and cannot be controlled. Besides these and many others, more or less chimerical, is the possibility of accepting whatever happens as the inevitable. Although to accept submissively the sovereignty of the Father of Waters might prove the most profitable thing to do, yet, it is hardly in keeping with the spirit of the American people.

Of the various possible courses suggested, each has its difficulties and its problems. Probably the greatest difficulties to be encountered will be the political. After fifty years of effort at making the river navigable, it can hardly be expected that that project will be given up even if it is economically unsound, in fact much agitation is under way for expendi-

tures far exceeding anything appropriated in the past. Likewise the setting back of the levees with the condemnation proceedings for necessary developed lands seems to have insuperable difficulties. To reorganize the flood-threatened area on an economical basis that floods cannot be controlled also seems scarcely possible. The resultant erosional and depositional effects from the straightening of the river are so little

understood that this procedure cannot very well be started now. The development of the spillways seems to offer the least problems and perhaps, for that reason, have been adopted at least in part. It is to be hoped, but hardly to be expected, that the future development in contrast with the past will follow economic lines and make of the Mississippi an added asset instead of a heavy liability.



## SHEEP INDUSTRY OF SOUTHEASTERN OHIO

*Langdon White and Clyde E. Cooper*

MANY people think of southeastern Ohio as a billowy land of bleating flocks—a land synonymous with sheep. Nor is this impression chimerical, inasmuch as the region has long been famous for its sheep and for little else in an agricultural way. In fact, it is frequently called “the fine wool-section of the nation.” Yet, an attempt to learn more of the geography of sheep in Ohio discloses the astonishing anomaly that, with few exceptions, little critical literature exists. What there is consists mostly of broad generalizations.

This paper purposes to present both verbally and graphically, the high lights of Ohio's sheep industry from the first Census year, and to forecast its future.

### HISTORICAL FEATURES

Sheep rearing and pioneering in the United States often went hand in hand. Ohio's first sheep arrived in 1807, when a small flock of some 25 or 30 Merinos was brought into Muskingum County. These were, incidentally, the first fine-wooled sheep to cross the Appalachian barrier. From this modest beginning and by subsequent additions, Ohio had in 1840 some 2,028,401 sheep, more than half of which were in the counties shown in Fig. 1. Thus, from the very beginning, sheep rearing has been of more or less importance in this section of the state, at times, becoming a major industry.

The tide of immigration rushing into the Middle West during the late thirties and early forties afforded an

appreciable market for wool, resulting in relatively small eastward shipments, though some, of course, moved in that direction from the older sections of the Ohio Valley. Wool, of all products, was best able to bear transport charges across the mountains. One pound of the cheapest grade carried 10 pounds to market (even from Illinois), whereas a pound of the best transported its own weight 20 times. Wool could be grown within 200 miles of an embarkation point, and \$1,000 worth could be delivered in a vehicle drawn by two horses. Bulky farm crops, on the other hand, had to be produced within a day's haul of a waterway or railroad, and little of the Middle West was so situated until the later forties. Accordingly, this was the sheep man's day, and so it remained until the advent of superior transport facilities.

### CONDITIONS FROM 1840 TO 1930

Figure 2 shows some of the kaleidoscopic aspects of Ohio's sheep industry from 1840 to 1930. The most striking fact indicated is that from the first Census year to the last, the *densest* sheep population has been concentrated in the southern end of the glaciated portion of the Allegheny Plateau and the eastern edge of the Corn Belt, and *not* in the very southern and eastern sections as is generally believed. During the decade 1850–1860 a slump occurred in the price of wool and a notable sacrifice in sheep resulted. Accordingly, beef cattle, in large numbers, displaced sheep in southern Ohio and

dairying came into prominence in the Western Reserve.

Production soared after 1860 due to the War Between the States and the consequent dearth of cotton. But, wool prices tobogganed as soon

numbers accordingly declined by the wholesale—good animals being sold for \$1 and \$2 per head, which a year earlier had been held at \$20 to \$40. Many were killed for their pelts and tallow alone.

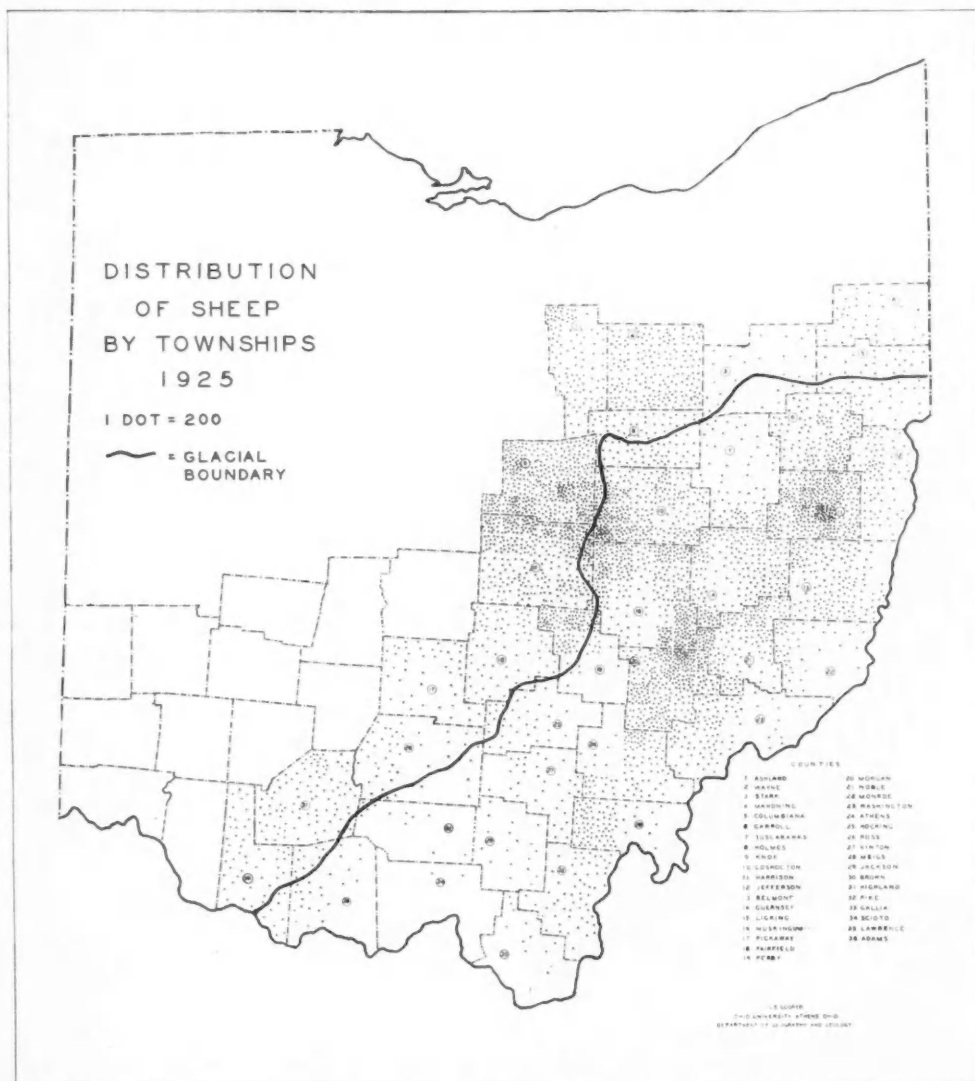


FIGURE 1.—Distribution of sheep by townships in 1925 in the 36 counties treated in this study. Note the paucity of sheep in the southern and eastern counties.

as the War terminated, the currency price for Ohio wool averaging 38 per cent less for the clips of 1867–1870 than for those of 1862–1866. Sheep

Ohio's banner Census year for numbers was 1870, when the state had 4,928,635 and the section considered in this paper (Fig. 1) had

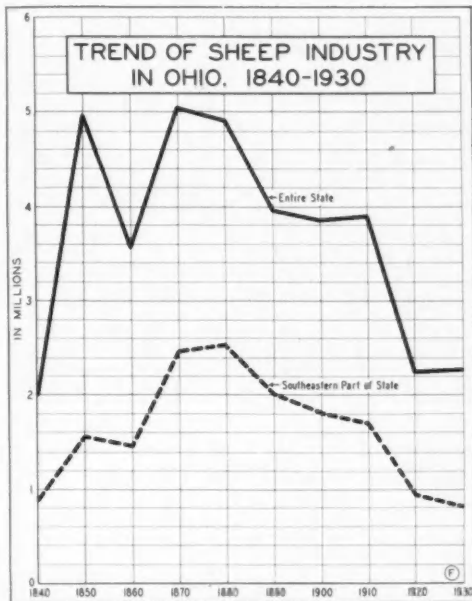


FIGURE 2.—Few agricultural enterprises have followed so tortuous a course—a situation largely attributable to the violent fluctuations in the price of wool. Note that the course for southeastern Ohio is less abrupt than that for the state as a whole—a consequence of the rigid system of farming imposed by a hard environment: the hill farmers have few choices in comparison with their more favored neighbors in the Corn Belt. Moreover, they are naturally more conservative. Many sheep men in the hilly section of Ohio keep about the same number of sheep year in and year out, “regardless of price, depending upon efficient flock management to make a fair profit on the average.”

2,757,834 or 55 per cent of the total. Sheep had, by this time, spread into every section of Ohio. But, a decline for the state as a whole was soon to take place. Yet, this did not affect the 36 counties of southeastern Ohio to the same extent, since their farmers had relatively few choices: they could not easily shift from one farm enterprise to another, because of a hard and unyielding natural environment (Figs. 3 and 4). They are, moreover, very conservative, being “the last to discard the old and the last to adopt the new.” Elsewhere, sheep were declining because of competition with other farm enterprises, improved transportation with

resultant reduced freight rates, more especially on bulky products, and declining wool prices resulting from a world-wide shift in the world sheep situation, particularly in the southern hemisphere.

The period 1880–1890 marks the sharpest reduction in numbers, for the farmers cut their flocks nearly one-half—a reaction consequent upon low prices (Table I). The decrease since 1890 is attributable to tariff legislation. A slight increase from 1900 to 1910 occurred by reason of an upward trend in the wool market. Following 1910, numbers fell off almost half by the 1920 Census, and by 1925 still another decrease, though small, had ensued. After 1925 there is an increase (Table I), especially on farms in the western part of the state, where sheep have been unimportant heretofore.

#### A BROKEN LAND

The plateau section of southeastern Ohio is naturally favorable to sheep-raising. The country is rugged and hilly with a paucity of flat land, inhospitable to tillers of the soil, and hence an area to be shunned by them (Fig. 5). Yet, many farmers settled in the region, because, coming from the South and East, they did not know of the better lands beyond, and in addition they had to push the Indian before them. Relatively few counties east of the 99th meridian have more than 50 per cent of their land in pasture, but much of southeastern Ohio does. Twenty of the 36 counties considered in this study (Fig. 1) have a larger percentage of their total farm land devoted to pasture than to crops. Moreover, southeastern Ohio is one of four sections in the United States where improved pasture is most con-



FIGURE 3.—Typical scene in Palmer Township, Washington County, Ohio. Obviously such land is too rough for tillage and must, therefore, be kept in pasture. Sheep graze such slopes to advantage, feeding avidly upon the weeds and grasses. (Courtesy of U. S. Dept. of Agric.)

centrated. Only 37 per cent of the farm land is cultivated.

The eastern half of the state consists of a regular succession of green, billowy hills and sharp ridges, separated here and there by deep narrow valleys (Fig. 5). This is the western extension of the Allegheny Plateau, but it has lost well-nigh every vestige of its former plateau character, except the skyline which shows accordance. Dissection has been pro-

nounced, especially along the Ohio River and its larger tributaries, which are abruptly flanked by high hills. Some of the valleys are as much as 300 feet deep. In places sandstone and conglomerate cap the hills, and being very resistant to erosion "tend to hold up the country, while the layers of soft shale weather rapidly thereby accelerating erosion," and causing deep valleys with steep slopes, such as those in the rougher



FIGURE 4.—Typical scene in Palmer Township, Washington County, Ohio. Three-fourths of the farmers in this area possess flocks of fine-wooled sheep. In 1920 Ohio alone had 40 per cent of the nation's pure-bred Merinos, chiefly Delaines. (See Figure 3.) (Courtesy of U. S. Dept. of Agric.)



FIGURE 5.—Physiographic map of Ohio. It will be noted that the non-glaciated plateau's topography is the most accentuated division of the State. It can, therefore, be utilized best by livestock, especially sheep. A comparison of Figures 1 and 5 is enlightening. In Ohio's more level stretches to the north and west, where cultivation is comparatively easy, sheep husbandry has been unable to hold its place in competition with wheat, corn, cattle, and hogs. (Courtesy of A. K. Lobeck.)

portions of Hocking, Lawrence, Pike, Ross, and Scioto Counties. Yet, even here lie small sections—*islands in a sense*, where the rolling to hilly terrain permits man to grow a few crops. These areas are often more or

less undissected parts of the plateau, and upon them lie some of the best farms of southeastern Ohio.

The northern fringe of the hill country is more subdued because the ice sheet, ruthlessly over-riding the



country, planed off prominences and filled in depressions reducing the relief very materially. Moreover, the hills in the zone immediately to the south of the limit of ice invasion are more rounded than those farther south, since in many valleys glacial waters were ponded and formed lakes (Fig. 5). Such areas, while quite suitable for tillage, are less so than those in the glaciated Corn Belt to the west. Yet, the glacier branded its mark on much of the non-glaciated section during its reign, for many south-flowing rivers, e.g. the Hocking, Licking, Muskingum, and Scioto, overloaded with débris, greatly aggraded their valleys to a height of 80 or more feet above their present beds. With the retreat of the ice, the streams began to degrade their channels, but have not yet succeeded in reaching their former levels in all places, nor in widening their valleys to their former extent. The higher lying segments of the valley trains form drift terraces, which man has utilized for farming (often trucking) and for urban sites. Back water terraces lie in the tributary valleys. The bottom lands or terraces in southeastern Ohio consist primarily of glacial outwash deposited at the time of the ice invasion, and of deposits due to almost yearly flooding; such lands constitute no inconsiderable part of the area, Washington County alone having about 32,650 acres. Such acreages add appreciably to the cultivable area, though they are occasionally subject to serious overflow.

Here and there hills produce crops, where grasses and non-intertilled crops in rotation retard erosion by binding the land together. Nearly all the soils in this area need lime, especially those growing legumes.

TABLE I

SHEEP POPULATION OF OHIO AND OF SOUTHEASTERN OHIO  
BY DECADES, 1840-1930

	<i>All Ohio</i>	<i>Southeastern Ohio</i>	<i>Per Cent</i>
1840 .....	2,028,401	1,113,621	54
1850 .....	3,942,929	1,968,617	49
1860 .....	3,546,767	1,854,308	52
1870 .....	4,928,635	2,757,834	55
1880 .....	4,902,486	2,782,989	57
1890 .....	2,887,400	2,287,475	79
1900 .....	2,648,250	1,487,584	56
1910 .....	2,890,163	1,640,582	56
1920 .....	1,566,527	858,100	54
1925 .....	1,493,446	790,344	52
*1930 .....	2,065,000	1,017,000	49

\* Preliminary estimate, subject to revision. Ohio Experiment Station.

### EASTERN OHIO STILL A SHEEP STRONGHOLD

Sheep have persisted in this region for the following reasons: (1) Rugged relief. As stated hitherto, the tiller of the soil invariably avoids this region. Comprising about one-fourth of the state's area, the non-glaciated section (Fig. 5) produces scarcely one-eighth of the crops. The per acre yields are appreciably less than in the glaciated section. Therefore, if such an area is to function agriculturally, it can serve best as pasture. Bluegrass and clover grow on the soils well stocked with limestone, but only sparse, almost valueless herbage occurs where it is wanting. Once the grasses become established, the sod improves year by year; even, close cropping improves the quality and keeps down weeds. The typical farm here probably includes about 65 per cent of its 150 to 190 acres in pasture, about 10 per cent in woods and wasteland, and 25 per cent in crops, of which hay, corn, wheat, and oats predominate in the order named. When this section was first settled, more land was under the plow than now; intense competition with level land elsewhere permits the cropping of only those fields least subject to erosion and worked with greatest facility.

(2) Poor soils. Some of these soils are naturally infertile because they

are derived from sandstone and shale, but probably the lack of fertility has more relation to slope and erosion than to underlying formations.

(3) The average farm is a one-man enterprise, that is, it is operated by the farmer and his family with a minimum expenditure for labor. By rearing sheep, little labor is needed, a cogent factor in an unprosperous region. Livestock accounts for from 63 to 93 per cent of the total farm receipts in those localities having

(5) Proximity to the Corn Belt with consequent low feeding costs. Too much significance should not be attached to this point, however, as most flocks get little grain except prior to and during lambing time, and when the lambs are being conditioned for market.

(6) Relative nearness to terminal markets and centers of consumption with consequent transport advantages, e.g. wool shipped from Columbus to Boston, wool capital of the

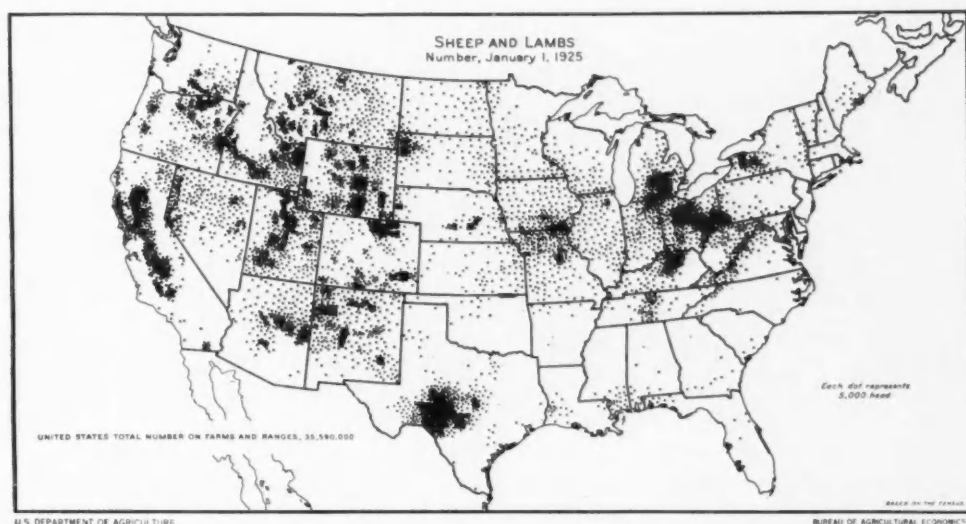


FIGURE 6.—This map indicates that southeastern Ohio is not only one of the few sheep areas left in the East, but it is the most important. (Courtesy of U. S. Dept. of Agric.)

business records. Wool accounts for about 75 per cent of the income from sheep.

(4) Momentum of an early start. Through trial and error, these folk have learned that sheep rearing is one of the most profitable branches of farming they can engage in. By careful breeding and selection, they have developed the Delaine (a type of Merino), which supplies not only superior wool but also good mutton. Ohio wool commands the highest market price in the United States.

nation, costs 78 cents per 100 pounds (1922) as against \$2.44 from Pocatello and \$1.50 from Portland, Oregon.

(7) Cheap land. It is valued at \$25 to \$30 per acre and the most hilly and isolated can be bought at prices as low as \$7 to \$10.

#### DECLINE OF SHEEP

Despite the fact that Ohio persists as one of the very few sheep areas in the agricultural and industrial East (Fig. 6), numbers have declined

greatly since 1870, consequent upon a series of causes:

(1) Probably the most far-reaching is the sheep-killing dog (Fig. 7). In the 36 counties comprising our area (Fig. 1), there were in 1925, 169,441 dogs, which killed 3,089 sheep. Dogs are destructively numerous in the leading coal-producing counties. It is highly significant

they no longer keep sheep, informed the writers that the industry is unprofitable and gave dogs as their greatest single cause of discouragement. The Department of Agriculture in a recent investigation found that dogs were accused of preventing an increase in farm flocks in 60 per cent of the replies received. Dog-tight fences, costly to build and



FIGURE 7.—A splendid example of economic waste. These fifty sheep, valued at \$1,000, were killed in one night by two dogs. Thirty-eight were ewes with lamb. Only four of the flock escaped and these were badly mangled. It is patent that sheep and dogs cannot inhabit the same areas, if the former are to prosper. (Courtesy of U. S. Dept. of Agric.)

that if maps indicating the distribution of sheep and coal production in eastern Ohio be superimposed one upon the other, they will not coincide (Figs. 1 and 8). It is well known that miners invariably have dogs, most of them underfed because of mining conditions. Hence, sheep are conspicuously absent. Many farmers in this region, when asked why

difficult to maintain, present real hurdles in the way of the hard-working but poor farmers. While Ohio reimburses the farmer who loses sheep killed by dogs, the amount seldom compensates for the intrinsic worth of the animals, especially where blooded stock is kept. Neither does it take into account the damage due to flocks because of fright.

Sheep are very nervous and the fright consequent upon a raid by dogs leaves them in a demoralized condition, so that they do not, for many days, feed at ease. Moreover, if such a raid takes place shortly before lambing time, parturition is not normally accomplished, many lambs being still-born. To some extent sheep are being supplanted by beef cattle in the dog-infested areas, though such animals do not graze steep slopes to best advantage.

(2) The growth of the sheep industry in the southern hemisphere after the Civil War. From 1865 to 1870 Australasia's wool exports increased 337 per cent, South Africa's more than 100 per cent, and South America's (the River Plate countries) about 150 per cent, whereas our own clip increased only about 66 per cent; possibly much of the increase in the United States was due to the heavier fleeces secured by careful selection and breeding. In 1840 the average Ohio fleece weighed only 2 pounds, while in 1924 it had increased to 7.3. Many flocks in Morgan and Noble Counties have sheep whose fleeces average 9.06 pounds.

(3) In parts of the region, farms have dwindled in size, so that room does not exist for both dairy cattle and sheep, and since the former are the more essential, sheep have declined. Farms of less than 100 acres are too small to support the farm family; they should be 150 or more acres in size.

(4) Unfavorable tariff legislation frequently has fallen like a bomb upon the wool industry of Ohio, causing sheep to fall off precipitously. This occurred especially after the Civil War and as late as 1888, when good grade sheep were sold for \$2 or less per head. This was the goad



FIGURE 8.—Coal-producing area and the chief coal fields of Ohio. Few sheep are reared in the coal mining sections because of the menace of dogs. (Compare Figures 8 and 1.)

that pricked the farmers into introducing the Delaine breed; they realized at last that wool growing could be profitable only when combined with mutton raising.

(5) Inroads of market gardening and dairying, especially near the large urban centers.

(6) Competition with the Far West, where great droves numbering thousands guided by a single herder and occasionally a camp attendant wander over the Public Domain or browse in the National Forests.

(7) The loss in agricultural population and the abandonment of much land formerly in farms.

(8) The inroads of parasites formerly almost unknown.

#### OUTLOOK

The history of sheep husbandry in southeastern Ohio from the pioneer period apparently predicts its future. Topography alone could, and probably will, determine the use of the greater part of the region for pasture. With considerably less than

half its land in crops, this section's future agriculturally seems definitely shaped.

Certainly the farmers, by rearing sheep, are adjusting themselves here effectually to their geographic milieu: they are working with and not against nature and economic laws. While they have tried beef cattle in many places, they have not found them well suited to the steeper slopes. It may be that sheep rearing as a company project will be developed in this section, for large tracts of hill land can be purchased for from \$7.00 to \$10.00 per acre. With dog-proof fences and a few Mexican herders, money might be made.

If America's sheep population is to increase in the future, it must depend upon farm flocks in the East rather than upon range droves in the West, for most of the ranges are stocked to capacity. And in this development, eastern Ohio (Fig. 1), conspicuously the home of the sheep, will play a dominant rôle, though the rate and amount of increase will depend upon the adoption of more scientific practices, as for example, the restoration of old pastures with limestone and phosphorus. Limestone could be procured economically, even in the remotest sections, by utilizing portable crushers, jointly owned, on the widely scattered outcrops.



## CHILEAN NITRATE AND THE NITROGEN REVOLUTION

*R. H. Whitbeck*

**R**EGULAR shipments of nitrate of soda from the desert of Atacama began a century since. Peru was then in possession of the great nitrate deposits, the only fields of any consequence in the world. A half century later, in the War of the Pacific, Peru (and Bolivia) lost her right in these valuable mineral lands and the vigorous Republic of Chile assumed ownership.

In the past century about two billion dollars' worth of nitrate has been exported, and for decades, the largest source of revenue to the Chilean government has been the export tax of 10 to 12 dollars a ton levied on shipments of nitrate. At times half the revenues of the nation came from this source. As Chile had a complete monopoly of natural nitrate of soda, the Chilean statesmen came to feel that the nitrate revenue was dependable and permanent. The fiscal system of the nation was built around the nitrate tax, and the treasury became dependent upon it. But, the century of nitrate production now ends with nothing short of a revolution. The phenomenal increase in the output of manufactured nitrogen compounds, which actively compete with Chilean nitrate, has not only destroyed the Chilean monopoly but threatens the very life of the great industry. It is another instance of the uncertainty of even seemingly permanent industries. It illustrates the risk that men or nations take when they invest huge sums in an enterprise whose very existence may be endangered or ended by some revolutionary change of man's making.

Whereas, in the 1890's, Chilean nitrate supplied about four-fifths of the inorganic nitrogen used in the world, it now supplies less than one-fifth, although the absolute production has kept up nearly to its maximum.

Nitrogen is one of the world's fertilizers, for soils, deficient in this essential plant food, must be properly supplied if crops are to be raised, either by growing legumes, or by applying fertilizers containing the element in form available for plant growth. Its use in explosives has made an adequate supply a matter of concern to every nation as a matter of defense. Not only must the supply be adequate; it must be assured against submarine and other offensive warfare; and so no nation dares depend upon Chile as the only source.

### LOCATION AND ORIGIN OF CHILEAN DEPOSITS

The Chilean nitrate beds are irregularly scattered throughout a region of absolute desert in northern Chile extending from 19° S. latitude to 26° S., a distance of 450 miles. They lie in the trough between the coastal range of low mountains on the west and the lofty Cordillera of the Andes on the east, and at elevations ranging from 4,000 feet to 9,000 feet. Some of the beds are within 15 miles of the Pacific, while others are as much as 80 or 90 miles inland (Fig. 1). The deposits are exceedingly irregular in distribution, in thickness, and in richness.

It is an impressive fact that this salt, shipped to nearly every part of the world to promote the growth of

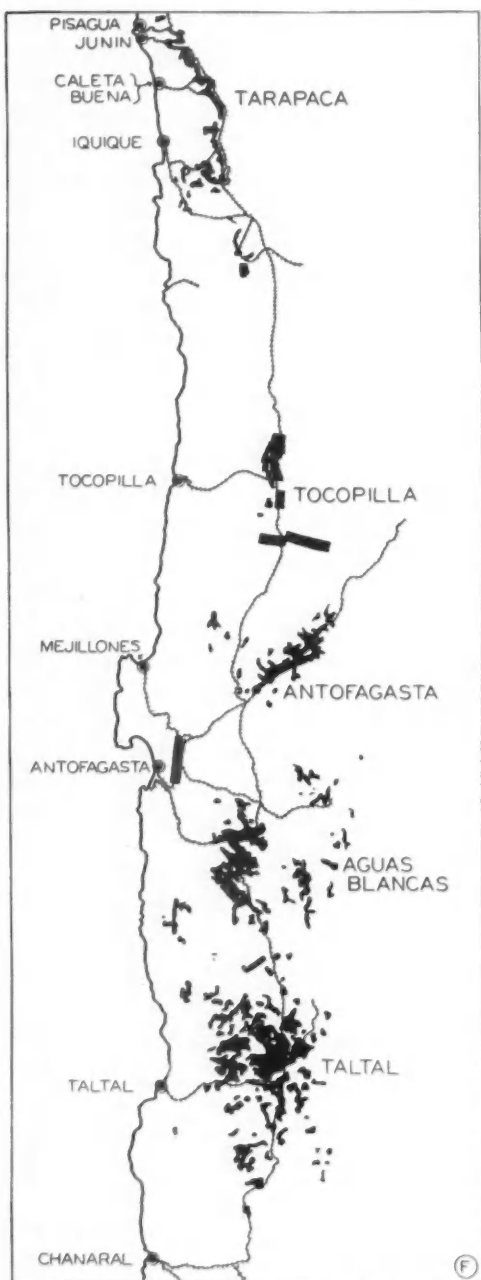


FIGURE 1.—The nitrate zone extends from 19° south latitude near the port of Pisagua to 26° south, a short distance beyond Taltal. In this stretch are five major nitrate producing districts each of which is served by one or more near-by ports. The deposits lie in the lower parts of the pampas, between the foothills of the coast ranges to the west and the lower slopes of the Andes to the east. Within the limits of a particular deposit there is marked variation in extent, thickness, depth, and grade. (Courtesy of Clarence F. Jones.)

food plants, supports scarcely a blade of grass in the region where it abounds. The desert of Atacama is one of the most absolute deserts in all the world. For years not a drop of rain falls, and when a little shower does occur, the thirsty land absorbs it like a sponge. The nitrate region is in the belts of the Southeast Trades and the southern Horse Latitudes. The Trades, of course, could bring no moisture across the two thousand miles of continent and over the lofty Andes to this region of Atacama. The Horse Latitudes are regions of descending, and hence of dry, air. They are desert-inducing calms wherever they occur. The local conditions are also drought-producing. The cold Humboldt Current, flowing northward along this coast, cools the air above it, and when such air flows landward and over the hot coastal region, it becomes warmer and drier as it advances across the nitrate pampas. The great beds of nitrate would never have been formed if the climate had not been arid, and they are preserved here only because no rain—virtually none—ever falls upon them, for nitrate of soda is easily dissolved in water. We are accustomed to thinking of ample rainfall as a blessing and of drought as a blight. Here in northern Chile lies that country's greatest source of wealth, formed there and preserved there because the land is a desert.

#### THEORIES OF ORIGIN

The origin of the nitrate deposits is still a geological mystery, and various theories to account for them have been advanced. The rather large iodine content of the nitrate has suggested that it might have come from accumulations of seaweed, which is the chief-known source of iodine.

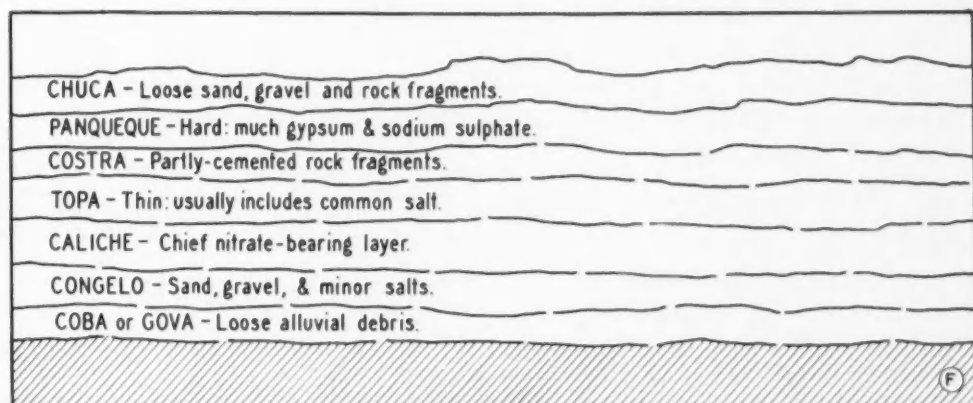


FIGURE 2.—The stratigraphy of the Chilean nitrate beds; a generalized section.

Another theory holds that the nitrate is derived from ancient beds of guano deposited along the old shore line as guano has more recently been deposited in great quantities on islands along the coast of Peru, a little further north. A third theory "ascribes the genesis of the nitrate to the action of nitrifying organisms in ancient vegetable matter in the soil of the region." The nitrate thus formed is assumed afterward to have been concentrated in beds by the action of ground water.

Miller and Singewald "believe that the nitrate deposits have resulted from the accumulation, by means of evaporation, of the minute nitrate content of the underground water of the region."<sup>1</sup>

None of the theories has met with general acceptance and the problem remains unsolved.

#### CHARACTER OF NITRATE BEDS

The long valley through which the nitrate and associated salts occur is filled to a considerable depth with sand, clay, and gravel which have been brought here by the action of

wind and temporary mountain streams. In these porous beds of debris, underground waters have left the salts which crystallized out of the rising and evaporating ground waters. The salts form a cementing material filling most of the cavities in one particular layer which is referred to as the *caliche*. The surface of the nitrate pampa slopes gently toward the west and the nitrate occurs mainly, but not exclusively, in the western side of the valley near the coast range where the water table comes very close to the surface. When all of the different layers are present—and they are seldom all present—the series is essentially as shown in Figure 2.

Nitrate may occur in other layers, but most of it is obtained from the *caliche*, which lies at depths from several inches to several feet below the surface and may be of any thickness up to 12 or 14 feet, but averages nearer one foot. Even the *caliche* varies widely in nitrate content, ranging from a small per cent of the total weight up to the unusual figure of 60 per cent. Under the old method of treatment 12 per cent ore was about as low as could profitably be used. The distribution of the workable

<sup>1</sup>See Miller, B.L., and Singewald, J. T., "The Genesis of the Chilean Nitrates," *Econ. Geol.*, Vol. 11, pp. 103-114, 1912.

bodies of *caliche* is extremely irregular. They branch this way and that, pinch out, reappear and disappear in a bewildering fashion.

### MINING OPERATIONS

The surface conditions reveal little or nothing regarding the quantity of nitrate below. Before entering upon mining operations in a new area, many drill holes are sunk to deter-

material was sorted and loaded by hand (Fig. 3). Only the pieces which the workmen judged to be of a certain richness were loaded into the cars and sent to the treating plants (*oficinas*). All of the small pieces and finer material were lost, and all of the lean material was discarded. The element of waste was large, but could be borne so long as prices were good and Chilean nitrate held a virtual monopoly.



FIGURE 3.—Lumps of *caliche* (nitrate "ore") sorted and piled on the pampa by the old hand process. This process is being replaced by the power-shovel method. (Courtesy of U. S. Bur. of For. and Dom. Commerce.)

mine the conditions beneath. Maps of the probable pattern of the underground deposits of nitrate are made, and a plan of trenching is decided upon. Holes are drilled through the overlying material to the base of the *caliche*, and charges of powder or dynamite are shot off at the bottom. The explosion shatters the mass for some distance around. In the past the largest pieces of *caliche* had to be broken up with sledge hammers, for under the old system the fractured

But since the World War, great changes have come. Synthetic nitrate, made in Europe and the United States, has not only broken the Chilean monopoly but now dominates the nitrogen market and can determine prices. Hence, less wasteful methods of mining had to be devised, and these required also a change in methods of treatment at the treating plant.

Under the old system of hand-sorting and handling and the Shanks

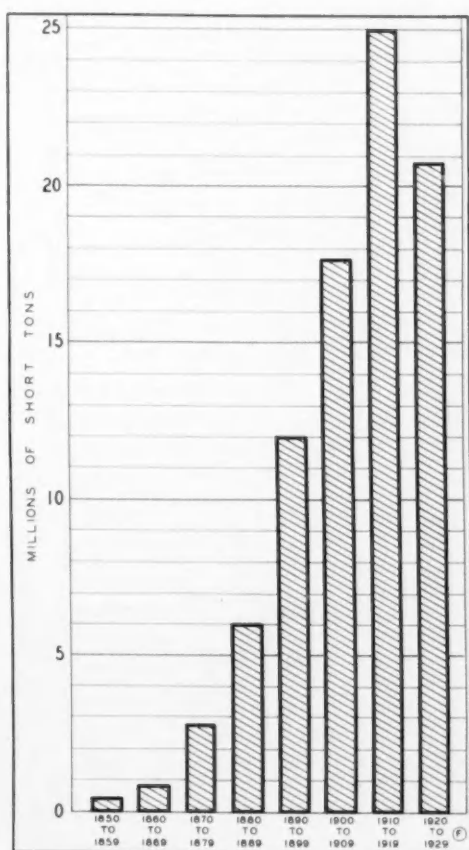


FIGURE 4.—Export of nitrate from Chile by decades.

process of treatment, the *average* costs were about as follows:<sup>2</sup>

TABLE I

	Per Ton
Cost of mining .....	\$ 4.08
Cost of transportation .....	1.28
Cost of treatment .....	4.40
Amortization .....	2.16
General expenses .....	1.04
Total .....	\$12.96

Thus the *average* cost of a ton of nitrate at the treating plant was about \$13.00. Of course, this average cost was below that in the less efficient properties and above that of the more efficient ones. When the nitrate reached the ports of Europe or the United States, it was customarily

<sup>2</sup>Bain and Mulliken, Nitrogen Survey, Trade Inf. Bul. No. 170 (1924) p. 3.

valued at about \$50.00 a ton, made up of the following items:

TABLE II

	Per Ton
Cost of production .....	\$13.00
Export tax .....	12.00
Sales expenses .....	6.20
Freight and Commission .....	8.80
Profit .....	10.00
Total .....	\$50.00

So long as prices were held at about \$50.00 a ton in the foreign port of receipt, most of the nitrate companies in Chile were able to make profits, and the most successful made excellent profits, often 25 to 40 per cent a year on the capital invested. Of the 170 nitrate plants that at one time were operating, some made small profits and some failed outright as they do in all industries.

#### TREATMENT OF THE CALICHE

*Caliche* that contains the requisite percentage of nitrate (usually 15 to 20) is taken to the crushers by narrow-gauge railways, crushed to the size of stove coal or smaller, and dumped into huge boiling pans where the hot water dissolves the soluble salts which are mainly common salt and nitrate. Owing to the fact that common salt precipitates from solution at a higher temperature than does the nitrate, the two are readily separated and the nitrate solution passes on to the cooling vats where it gradually crystallizes out, is removed and piled on the drying floors in the dry tropical air of this desert region. Later it is placed in bags of about 200 pounds and sent by rail to the ports for shipment. Fortunately the nitrate can be stored as long as necessary without deterioration.

The above process of treating the *caliche* was commonly used in the past and still is in use in the old plants that are operating; it is very wasteful, for only 60 or 65 per cent of



the nitrate is obtained from the solution. This loss, plus the waste in mining operations, has become a very serious matter since the competition of synthetic nitrate pushed prices to lower levels.

#### THE CRISIS

For several years the nitrate crisis in Chile has been growing more and more acute. The nation had become

place to get the real "natural" article. However, things have looked increasingly different since the World War. Germany, the largest pre-war buyer, is making all the nitrogen it needs and is exporting a surplus. England, France, the United States, and a few other countries are making and using more and more "artificial" nitrogen.

Although the production in Chile



FIGURE 5.—Long heaps of nitrate crystallized from saturated solution. It will dry in the sun for several days, be stored in huge piles in the open air of a rainless climate, and finally will be bagged for shipment. (Courtesy of U. S. Bur. of For. and Dom. Commerce.)

financially dependent upon the export tax which yielded from \$25,000,000 to \$35,000,000 a year. Approximately 50,000 laborers and their families depended upon the nitrate industry and one of the best outlets for Chilean farm products was in the nitrate camps. For a time the nitrate producers and government officials had taken the ground that there really was no danger from synthetic nitrogen. After all, the world must have nitrate, and Chile was the only

had risen from 200,000 tons in 1880 to 3,000,000 tons a year recently, the percentage of the world's supply of nitrogen that came from Chilean nitrate was rapidly falling, and in 1929–1930 it amounted to only 20 per cent. The period of the world's dependence upon Chilean nitrate evidently is at an end. The nitrate producers in Chile have clamored loudly for the removal of the export tax, and the government has insisted that if the producers would devote more science



FIGURE 6.—By means of such specially designed apparatus, the cost of mining and handling *caliche* and nitrate is greatly reduced. (Courtesy of U. S. Bur. of For. and Dom. Commerce.)

to methods of production and eliminate the inexcusable waste, they could make good profits and still pay the export tax, which the government believed it could not dispense with. Recent developments have shown that both of these changes are seemingly possible and probably essential.

#### TECHNICAL IMPROVEMENTS

It was fortunate that at this juncture one of the wealthiest and most progressive mining and metallurgical corporations in the world was already interested in mining enterprises in northern Chile. The Guggenheim Brothers, with their staff of chemists, engineers, and technical experts in all branches of mining and ore treatment, had perfected successful methods of mining and treating very low-grade Chilean copper ore on a large scale. The great success of the Chile Copper Corporation's work in the immediate neighborhood of the nitrate fields led the Guggenheims to put members of their splendid technical staff, led by E. A. Cappelen Smith, at work on the problem of devising more efficient methods of

mining and treating Chilean nitrate ores. A decade or more of time and a king's ransom in money have been devoted to the undertaking, and the efforts promise complete success. The Guggenheims acquired first one (Maria Elena), and later two (Lautaro), of the important nitrate properties and are further perfecting their new (and patented) processes. At first the old-line producers expressed open skepticism and displayed some hostility to the newcomers. The Chilean government watched every step in the developments with keenest interest, for the success of the new process might mean the preservation of Chile's greatest industry. The growth of synthetic nitrogen and the inevitable lowering of prices, made it clear that only radical changes could save the industry in Chile. Because those radical changes had to come, they have come. The Guggenheim interests, the other producers in Chile, and the Chilean government have come together, and a huge corporation—The Nitrogen Corporation of Chile, or Cosach for short—with a capitalization previously unknown in

South America (\$365,000,000), has been formed in which the Chilean government is half owner. The Guggenheim processes are to be used; the existing nitrate companies are being merged and the old *oficinas* will give place to a small number of large, modern, efficient plants; the export tax will be discontinued and will be replaced by (expected) dividends paid to the government from the profits of the company. The government's contribution will lie mainly in turning over to the new corporation vast holdings of undeveloped nitrate lands, estimated to contain 150,000,000 tons of nitrate.

The two great changes which the Guggenheim processes introduce are in the mining and handling methods, and in the method of treating the *caliche* in the *oficinas*. The latter process involves the cooling of the solution to the point of refrigeration and thus recovering not 60 but 90 per cent of the nitrate. The mining and transporting methods employ powerful shovels, 30-ton steel cars dumped bodily by a revolving dumper, and crushers capable of crushing 16,000 tons a day. One great electric-driven shovel does the work formerly done by scores of laborers. No sorting is required, for the new treating process in the *oficina* permits of the use of *caliche* of much lower grade than can be used by the Shank's process and it is crushed much finer. Twice as much nitrate is recovered with half the labor, and 18 per cent as much fuel (petroleum). Already the cost of producing a ton of nitrate has been considerably reduced, and further experience and larger-scale operations promise to cut the cost still further. The removal of the export tax cuts off 12 dollars a ton, and the improved effi-

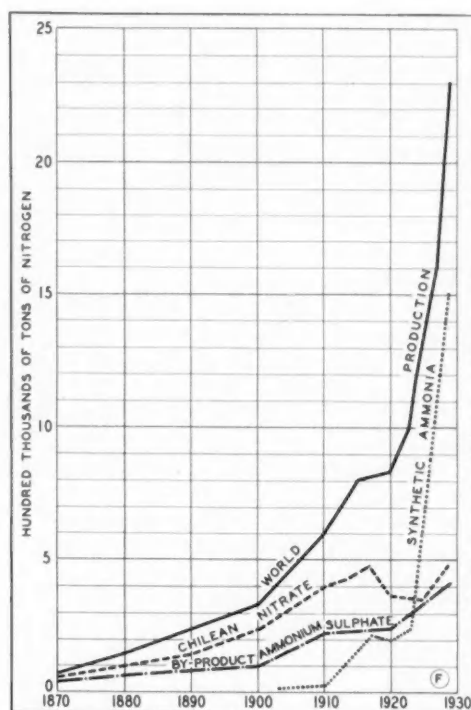


FIGURE 7.—World's production of nitrogen, 1870-1929, generalized by decades.

ciency of the new methods of treatment will doubtless reduce costs by another 8 or 10 dollars a ton. These reductions will bring the market price in foreign ports down to \$30.00 a ton or less, which is as low as the lowest prices yet offered by the makers of synthetic nitrogen, although not necessarily below prices that they may be able to offer and still make a profit.

#### PHENOMENAL RISE OF SYNTHETIC NITROGEN

Before the World War, nitrogen was being taken from the atmosphere and used in the making of various chemical products. The process then most used required great electric energy which was usually hydro-electric power. Norway had made notable advances in this line. During the War, Germany—under the stress of necessity—brought

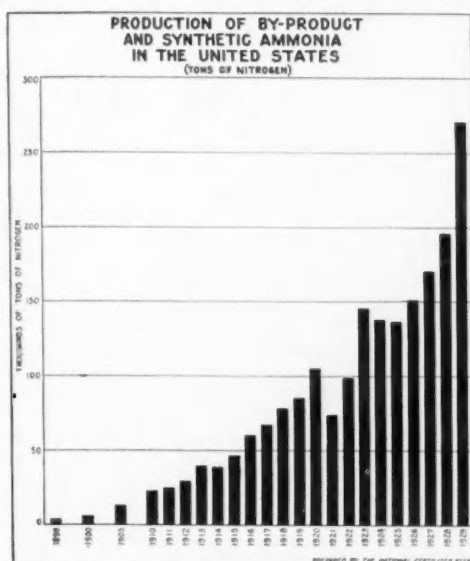


FIGURE 8.—The amount of ammonia produced in the United States has increased almost without interruption for thirty years. (Courtesy of National Fertilizer Assoc.)

other processes of nitrogen production to advanced stages of perfection which are being still further improved in Germany and elsewhere. Out of the experimentation and experience two types of nitrogen production have emerged as probably the most successful and least costly. One of these is referred to as the *by-product* process, because the ammonia (which contains the nitrogen) is obtained as a by-product in either of two industries, namely (1) in making coke from soft coal in by-product coke ovens, which have now largely displaced the old beehive coke ovens; and (2) in making illuminating or fuel gas. The nitrogen thus obtained is contained in ammonium sulphate which is one of the three nitrogen carriers most used in making nitrogen fertilizers. The other process is the production of synthetic ammonia. This has become by far the most important form of synthetic nitrogen, and the most serious rival

of Chilean nitrate. By-product ammonia has the disadvantage of being only a by-product, and the quantity that is produced is governed by the quantities of coke and manufactured fuel gas that are needed. An advantage of synthetic ammonia is that it can be made in any quantity desired.

Since by-product ammonium sulphate may be figured at almost any cost that the manufacturer sees fit to assign (it being only a by-product), the actual cost is not accurately determinable. This condition makes by-product ammonia a disagreeable competitor in the matter of prices, for it can be sold at whatever price it will bring.

The above graph reveals both the rapid increase in the production of commercial nitrogen in recent years, and the remarkable rise in the production of synthetic ammonia.

Synthetic ammonia is made by uniting pure hydrogen, usually obtained from water gas, and pure nitrogen (atmospheric) under great pressure over a catalyst. The gaseous product is liquified and is commonly shipped in tank cars to fertilizer works where it is combined to form some one of several compounds (sulphate, nitrate, and others) before it can be used as a fertilizer.

#### PRESENT SITUATION

The United States is the largest importer and user of Chilean nitrate, with a consumption of almost 1,000,000 tons a year. This is one-third of the annual Chilean output. Different nitrogen compounds contain very different proportions of nitrogen; hence, it is desirable in computations to refer to the actual nitrogen content by weight. Fig. 8 shows the rapid rise in the production of by-

product and synthetic ammonia in the United States. It is stated that this country is now able to produce at home all the nitrogen it could require under any conceivable circumstances. The leading European countries are providing for their needs and are exporting the surpluses. The world's capacity to produce nitrogen is already much beyond its current needs. In none of these countries, however, is the production and sale of nitrogen of anything like the critical importance

was taken by the official adoption of the Guggenheim processes and the formation of the Nitrate Corporation of Chile has already been referred to. The second step was a proposal to the principal nitrogen-producing nations of Europe to join with Chile in the formation of an international cartel whose purpose should be to limit production, allocate markets, and control prices, and thus, if possible, keep the industry on a profitable basis. The United States producers could not enter this cartel

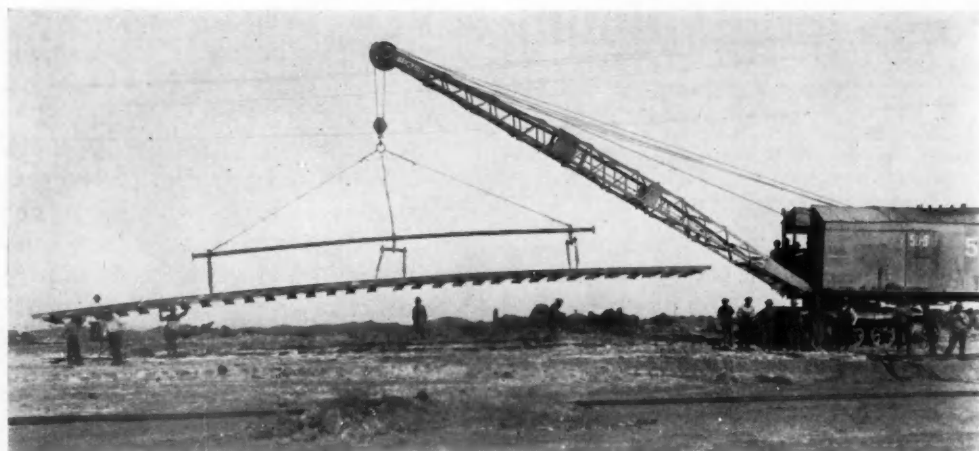


FIGURE 9.—Another labor-saving machine introduced by Americans and employed in moving the railway tracks in the nitrate fields of Chile. (Courtesy of U. S. Bur. of For. and Dom. Commerce.)

that it is in Chile. In the other countries the nitrogen industry is only one of many, but in Chile it is the industry of greatest significance in the economic life of the nation.

It recently became evident to the Chilean producers, as already indicated, that two very important steps must be taken if their industry is to be saved: (1) They must find ways to produce and market Chilean nitrate at materially lower cost; and (2) they must strive to prevent a price-cutting war among the nations that are producing surpluses of nitrogen. How the first of these steps

directly because of the provisions of the Sherman Anti-trust Law.

As the result of patient negotiations during 1930 this cartel was finally formed (for one year) and at present is functioning. It controls 80 per cent of the world's production of nitrogen and 98 per cent of that of Europe. Germany is the largest producer, followed in Europe by Great Britain, France, and Norway. There are about 100 plants in the world making synthetic nitrogen of which seven are in the United States. However, two companies in the United States make nearly all of it.



The excessively costly government plants at Muscle Shoals are of course producing nothing in the way of nitrogen or fertilizer and could not do so with their present equipment which was designed for processes already displaced by improved ones.

#### THE FUTURE

There seems to be no question that the Chilean nitrate industry faces a fight for existence. While the actual amount exported has been maintained in recent years, the proportion of the world's supply of nitrogen coming from Chile has declined about two-thirds. The recent increase in manufactured nitrogen in Europe and America has been phenomenal and there is large over-production. Chile no longer can control prices, although there is still a preference for "natural" nitrogen in some quarters. The old price of about \$50.00 a ton in European and American ports has already been reduced, and perhaps must go to \$30.00 a ton or even less. Every possible economy in production and marketing will be demanded. These economies may be possible if the huge Nitrate Corporation of Chile

is successful in bringing the whole Chilean industry under one competent control having government support. The international nitrogen cartel is an uncertain experiment, assured only for one year, but likely to continue longer. That it can continue for a long period seems—in human affairs—hardly likely. If the cartel should fail and unrestrained price cutting should follow, the Chilean industry, remotely located and hence burdened with rather heavy marketing costs, may find itself unable to meet the competition of manufactured nitrogen. The situation is not unlike the one that faced the Brazilian rubber interests when plantation rubber became well established. One important difference lies in the fact that any or all of the industrial nations can manufacture nitrogen at home, but Far Eastern plantation rubber must travel a long way to reach its markets. This difference might prove to be a serious one for Chilean nitrate, for the deciding factor in the nitrate contest may prove to be the cost of delivering the Chilean product to its users. The next 10 years will probably tell the story.

## ICELAND'S INDUSTRIES

*S. Axel Anderson*

GREATER progress has been made in agriculture, fishing, and commerce in Iceland during the last thirty years than during the preceding nine centuries. The Icelanders themselves believe that this recent progress is part of that general awakening in Iceland which characterizes the last seventy-five years, and which, from a political point of view, culminated in the establishment of the Kingdom of Iceland in 1918 with the King of Denmark as its titular head. Whether the causes have been political, economic, or psychological, the topic is nevertheless of considerable interest to the economic geographer.

### AGRICULTURE

Agriculture is still extensive and very primitive when compared with that of most other countries, but Iceland's unique geological and climatic conditions make comparisons with other countries unfair. In addition to the unfavorable factors of climate and soil, there is also that of location to which can be attributed, at least to a large extent, the political policies that for centuries made Iceland an isolated and neglected spot in the cold and distant North.

Iceland, located between 63.5° and 66.5° N., comprises 104,000 square kilometers or about 10,285,000 hectares. Of this area about 13,000 square kilometers are continually covered with snow, 12,000 square kilometers with lava, and 26,000 square kilometers are mostly sand and stone desert; the rest, about half of the total area, has a vegetation

that is mostly grass. Iceland is almost completely an island of volcanic rock formations (basalt and palagonite breccia). Since most such types of rock weather easily, there are in Iceland areas that have a relatively deep, stone-free, and fertile soil easy to cultivate, but so podsolized that crop agriculture is nearly prohibited.

The climate is changeable. In the agricultural areas the summers are rather cool and the winters are mild. Usually the summers are sufficiently warm to enable oats and rye to ripen fully, but in some years they may become very cool, especially when the floating ice piles up on the coast toward the North and the East. The average temperature of the whole island from 1873 to 1920 has been given as 2.8° C. July and August are the warmest months of the year and have an average temperature of from 10° to 13° C. The precipitation varies greatly among the different localities; it is least in the North with 345 millimeters and greatest in the South with 1,320 millimeters.

Under such conditions, highly developed agricultural industry is not likely to prevail. Nevertheless, throughout the centuries farming has been the chief occupation of the people and still provides a living for a larger number of individuals than any other industry. In the early part of the nineteenth century 85 per cent of the inhabitants gained their living from farming while in 1924 approximately only 40 per cent were dependent upon this industry. Of the total exports of Iceland, the

value of agricultural products amounted to 11.4 per cent in 1928 and 11.7 per cent in 1929.

Farming in Iceland is distinctly pastoral; there is no intensive agriculture. From earliest times the natural grass lands of the island have dominated agriculture and for more than a thousand years cattle raising has been the chief means of liveli-

that additional land was brought under cultivation. A few generations ago fully half of the land consisted either of national estates or church lands, but now more than 80 per cent of the land is privately owned, the rest being state or municipal property.

A general exodus of population from farm to town has taken place in

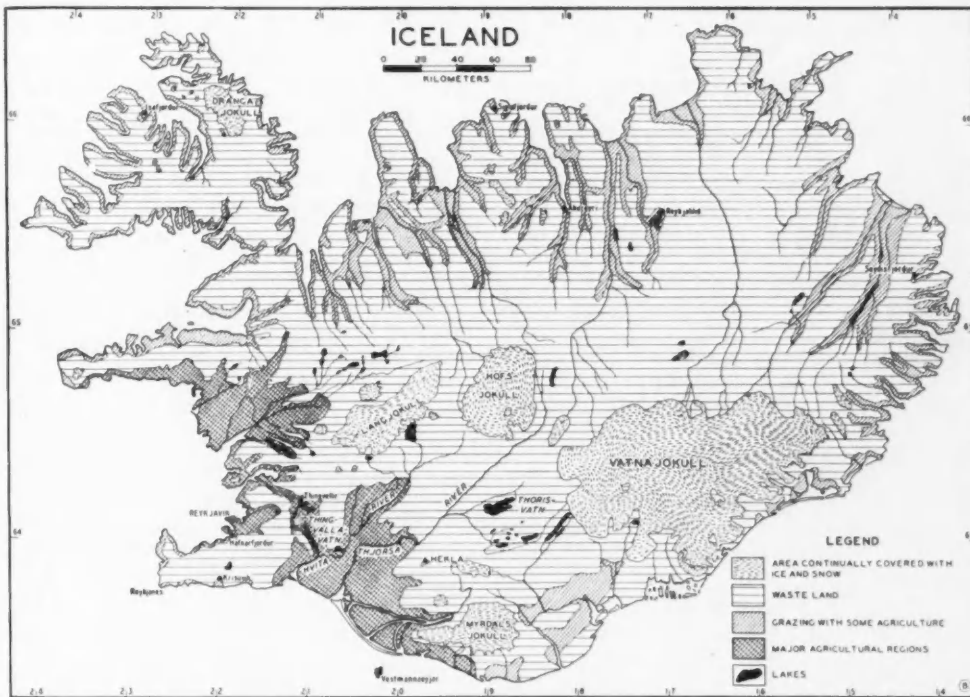


FIGURE 1.—The Iceland terrain. The chief physical features, and the use of the land, are presented in detail, indicating the relation of the crops and pastures to the character of the land.

hood of the rather sparse population. The farms are spread out over the entire inhabited area, and since the uncultivated areas are very extensive in comparison to the cultivated plots, the value of a farm depends primarily upon the quality of the soil. In 1855 there were 5,621 farms in Iceland, and in 1921 they were reported to number 6,430. This increase in the number of farms can be ascribed almost entirely to the fact

Iceland, but the change in occupation has generally not been from farmhand to factory worker, because there are few factories in Iceland; it has been more a migration from the farm to the fishing village or town to secure work on the fishing boats, or on shore in the preparation of the fish for the market. The unprecedented progress of the fishing industry in recent years has exerted a marked influence upon the distribu-



FIGURE 2.—A bit of typical Iceland coast where the rocky promontories rise sheer from the sea. (Courtesy of the Danish Consulate.)

tion of the population. In 1880 the only three towns in the whole country totaled 3,630 inhabitants. Now the town population numbers more than 35,000 or one-third of the population of the entire nation. In addition the number of trading stations, if

ural meadows or grass lands. Both types yield hay for fodder. There is, of course, some cultivation of the soil and a production of limited quantities of potatoes and root crops. The following data give some information pertaining to these products:

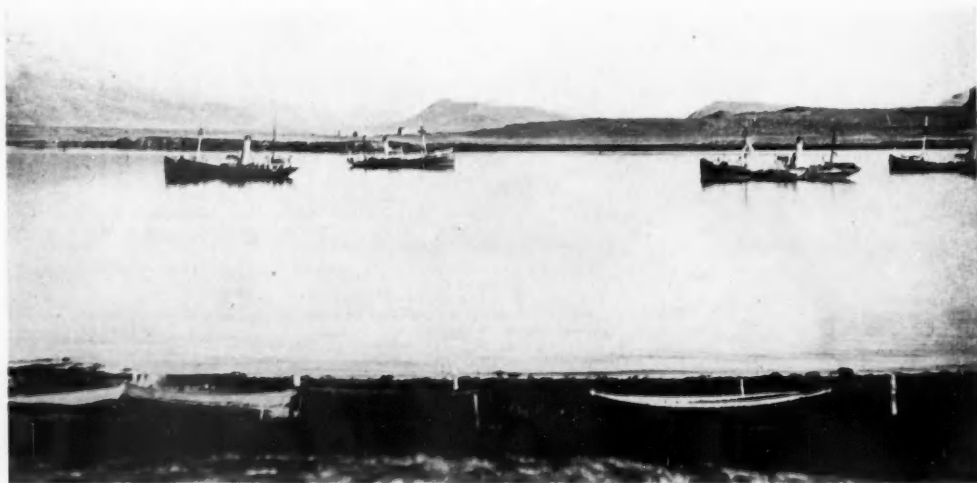


FIGURE 3.—Iceland trawlers at anchor in one of the placid landlocked harbors. (Courtesy of the Danish Consulate.)

included, would bring the urban population up to about half of that of the whole country.

As stated above, Icelandic farming is based on the cultivation of the grass, distinction being made between fertilized home fields and nat-

		Potatoes (Metric Tons)	Root Crops (Metric Tons)
1886-1890	Average yield.....	6,000	8,400
1901-1905	Average yield.....	18,000	17,100
1928	Total yield.....	42,000	15,000

The foodstuffs produced in Iceland are insufficient for the domestic needs and consequently large quantities

must be imported. In the case of potatoes, for example, the average import during the years 1919-1923 was 1,700 tons annually or about 40 per cent of the total quantity consumed.

Modern machinery is gradually being introduced to facilitate the cultivation of the land. Artificial fertilizers, which were hardly known in Iceland only five years ago, are now being imported. The quantities

far only moderate success has been attained. It may be too early to pass judgment on these projects at this time, but the rigorous short growing season and the infertile soil are seemingly difficult obstacles to overcome. The sand and lava-covered areas offer few opportunities for vegetation; in most cases only the *Marehalm* (*Elymus arenarius*), grown in order to prevent the sand from burying arable land, thrives.

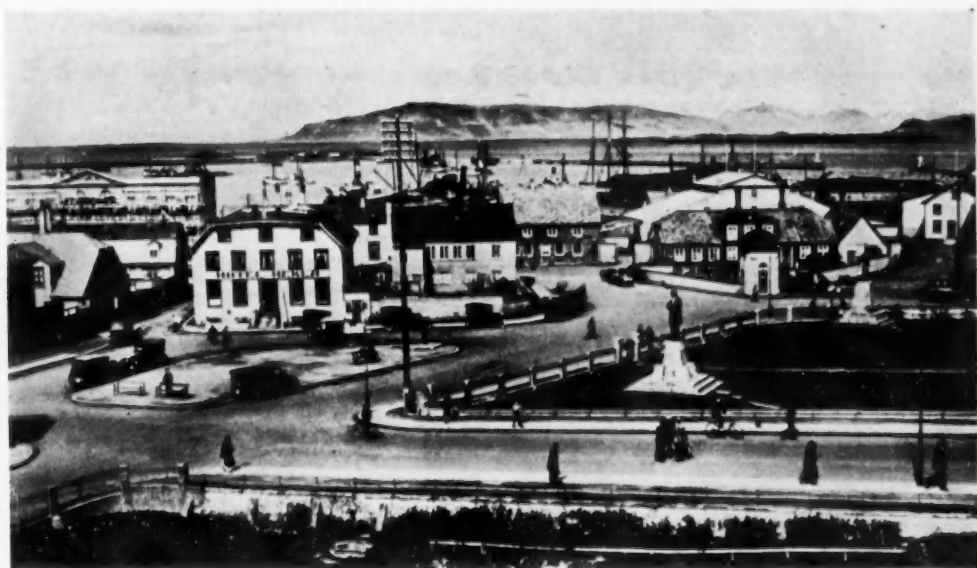


FIGURE 4.—The metropolis of Iceland, Reykjavik, where most of the social, economic, and political life of Iceland is centered. (Courtesy of Raymond & Whitcomb Co.)

imported during the last three years have been as follows:

	Metric Tons
1927 .....	250
1928 .....	880
1929 .....	1,340

There are no dense forests in Iceland. The scattered timber consists chiefly of birch trees. Iceland's so-called forests are mostly used as sheep-runs, although some wood is cut for fuel purposes. Lately attempts have been made to plant trees on a rather large scale, but thus

Since grass growing predominates, it is only natural that the cattle industry should have attained major importance. It is true, however, that the number of cattle found in Iceland today is considerably smaller than that of several centuries ago. The following data are intended to show the trend:

1730 .....	36,000
1830 .....	28,000
1900 .....	23,500
1928 .....	30,000

While the statistics of the last fifty years do not indicate any appreciable





FIGURE 5.—Iceland fishing-boat. The fisheries of Iceland—cod and herring particularly—yield the country a goodly part of its income. (Courtesy of the Danish Consulate.)

increase in the number of cattle, the cattle industry has nevertheless progressed and the returns in proportion to the investments are now very much greater than they were a few decades ago. Formerly the cattle were badly fed and received little or no care, many of the animals being allowed to graze out in the open the year round. During the last thirty years the Icelanders have come to realize the importance of good care and sufficient feed in animal husbandry and the returns have consequently increased.

Sheep are numerous; in fact there are six sheep to every person in Iceland, a larger number per capita than that of any other European country. In 1900 the sheep numbered 469,000, while in 1926 there were 627,000. Some exportation of live sheep has taken place, but not on a large scale; in 1896, for instance, about 60,000 sheep were shipped, the greater part going to Great Britain. From that time on the export has steadily declined, coming to an absolute standstill at the time of the World War, and then beginning anew but increasing only slowly in the years following the war.

There are not many goats in Iceland. The comparatively small number of about 2,700 is found in a rela-

tively small area in the North. This total indicates a decided increase since the year 1900 when the goats numbered only about 270.

In proportion to the population, horses are also more numerous in Iceland than elsewhere in Europe. There is at present about one horse to every two persons on the island. In 1900 there were 4,160 horses in Iceland and in 1928 they numbered 52,245. The Icelandic horse is really a pony, renowned for his perseverance, "sure-footedness" and unusual stamina. A considerable number of live horses have been exported during the last fifty years. Most have been shipped to Denmark where they are used by the small landowner whose land is not extensive enough to permit him to keep a larger horse. The number of horses exported has varied from 5,700 in 1899 to only a few hundred in some years, especially during the period of the World War. In 1929 the export of live horses numbered only 619 heads as against 1,314 in 1928 and 1,192 in 1927.

The milk produced in Iceland is generally insufficient for the domestic demand and consequently condensed milk is imported, chiefly from Denmark. On the other hand, some of the butter made at the creameries is exported to England while the butter



FIGURE 6.—Salted cod spread on the rocks to dry, and stacked in heaps for export. (Courtesy of Raymond & Whitcomb Co.)

made at the farms is absorbed by the local market. Of late an increased interest in dairying is evident; in 1929 two coöperative dairies were erected in the South of Iceland, one of them being the largest creamery in the country. Iceland, like Denmark and other European dairy countries of note, consumes considerable quantities of margarine. The greater part of this commodity is imported, but in recent years factories have been established which perhaps in time will be able to produce enough for the home market.

During the last ten years attempts have been made to develop a foreign market for Icelandic cheese. These endeavors have met notable success and it is likely that in the future, cheese will occupy a rather prominent place on the list of Iceland's exports.

Salted mutton constitutes the principal article of agricultural export. In 1928, 19,800 barrels of salted meat were exported, and in 1929, 20,800. The export of frozen mutton has increased rapidly in recent years; 350 tons were exported in 1927, 430 tons in 1928, and 700 tons in 1929. Norway receives the larger part of the salted mutton and England buys practically all the frozen mutton.

Due to the fact that construction of several additional refrigerating plants is under way, it is expected that upon their completion, the export of frozen mutton will reach a still higher figure.

The yearly export of wool has been about 800 tons which, by the way, constitutes practically the entire annual yield. The exact quantity exported in 1928 was 740 tons and in 1929 it reached 820 tons. Most of the wool is sent to the United States and Denmark.

The exports of salted sheep skins have increased several hundred per cent since 1900. No less than 365,000 skins were exported in 1927 and 430,000 in 1928.

Coöperative enterprise has played an important rôle in the economic life of the Icelanders. Their first coöperative buying and selling organizations were formed as early as 1880 and the history of these organizations indicates a period of continued progress. But the greatest strides in this field have been made since 1900, during which time many coöperative creameries, slaughter houses, and other industries have been established. The majority of the farmers are members of the societies that

manage these industrial enterprises as well as the numerous buying and selling societies that are found in the country.

### FISHING

While farming provides a living for about 40 per cent of Iceland's population, clearly agricultural products do not occupy a relatively conspicuous place among the nation's exports. It is largely the fishing industry that produces Iceland's relatively large exports. The following figures make this clear:

<i>Exports from Iceland in Million Icelandic Crowns</i>			
	1927	1928	1929
Various fish- ery prod- ucts. . . .	61.3 (88.3%)	66. (88.6%)	50. (87.5%)
Agricultural products.	8.1 (11.7%)	8.5 (11.4%)	7. (12.2%)

There is little doubt that fishing has been carried on by the inhabitants of Iceland from the time the early settlers first came to the island more than a thousand years ago. Fishing supplemented farming and the Icelanders have been engaged in both of these occupations throughout the centuries. Only in relatively recent times has fishing permitted man to derive his entire income from it. No fish were exported during the early centuries; the limited quantities obtained and the very inadequate means of transportation made an export trade in fish practically impossible. It was not until the fourteenth century that fish became an export article and then only in the form of dried cod for which there had developed by this time a considerable demand in England, Spain, and elsewhere on the continent.

But, the lucrative fishing on the banks off the coast of Iceland has never been a monopoly of Icelandic fishermen. Practically every year

during the last eighty or hundred years, foreign vessels have participated very actively in the fishing. In the later part of the nineteenth century large numbers of French vessels were engaged in the fishing off the coast of Iceland, and it is estimated that in the year 1876, for example, approximately 4,500 French fishermen were stationed in these waters. The catches brought to France in that year amounted to 12,300 tons of split cod. The returns obtained by the French in the following year were almost as great. It does seem hard to account for the severe depression felt in Iceland during these years; the foreign interests had better boats with which to obtain greater results. The competition by the French was especially disastrous since France normally was a very important customer of Icelandic cod. The fact that the French themselves brought cod to France meant that the fishermen of Iceland could not sell as much to the French importers as formerly. English, German, Dutch, and Scandinavian fishing boats, especially trawlers, which began to be used in large numbers after 1895, also came to the Icelandic banks in order to pursue their trade. Icelandic fishermen were strongly opposed to the foreigners' coming. The English particularly elicited resentment because of their alleged ruthless methods. It was held that the English caught everything, large and small fish alike, without thought of possible depletion, and in addition injured the bottom vegetation with their dragnets.

The competition brought about by the activities of the foreign boats seemingly acted as a spur to the Icelanders. Capital has always been

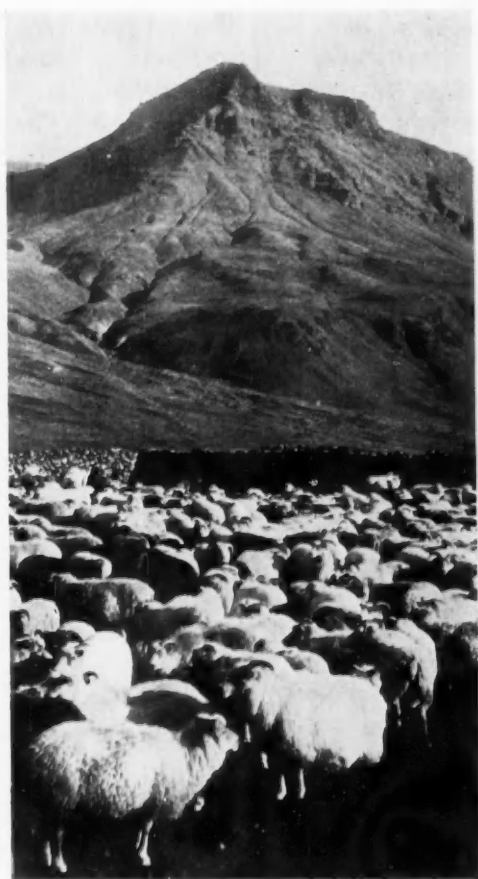


FIGURE 7.—Iceland sheep herded into their fold on the mountain foreland. (Courtesy of Raymond & Whitcomb Co.)

scarce in Iceland and it has been no easy matter for the Icelanders to purchase modern boats and equipment with which to secure for themselves a larger share of the remunerative fishing that was carried on along the shores of their island. In 1896 and 1897 a number of Icelanders bought several fishing cutters in England; they could not yet afford trawlers. For a number of years the Icelanders remained virtually passive while foreigners literally scooped fortunes out of the sea with the trawler. In Iceland there was constant talk about securing trawlers of its own and finally, in 1904, two small ones

were bought which, however, did not measure up to expectations. Not until 1907 did the first really modern and up-to-date trawlers with Icelandic home ports pursue fishing in the seas off Iceland. The trawler fleet of Iceland during the period from 1910 to 1919 was as follows:

<i>Trawlers</i>		<i>Trawlers</i>	
1910.....	6	1915.....	20
1911.....	10	1916.....	21
1912.....	20	1917.....	20
1913.....	18	1918.....	10
1914.....	19	1919.....	13

In the fall of 1917, when tonnage prices went soaring, ten trawlers were sold to France, but in the years that followed the number increased markedly and reached 47 in 1925. Since then there has been a decline, being only 40 in 1929. Most of the old cutters which were bought in England as mentioned were one after another sold to the Faroe Islands. In later years motors have been installed in most of the smaller fishing crafts and the fishing fleet is on the whole very much more efficient now than it was two decades ago. Toward the close of 1929 Iceland boasted 90 steamers of which 40 were trawlers; 630 motorships; 8 sailing vessels; and about 1,000 open boats of which perhaps half were equipped with motors.

As a rule the cruising radius of a fishing boat depends upon its size. A trawler or a larger boat equipped with a dependable motor can venture trips further away from the "home base" than can a smaller one. For this reason the fishing season of the various types of boats differs greatly in length. Trawlers and most motor vessels are active throughout the year, while the smaller vessels may have a fishing season of only a few months or even a few weeks, depending upon the



location of the banks on which they operate.

### COD FISHING

The greater part of Iceland's fishing fleet is engaged in the fishing of cod; motor boats and rowing boats pursue almost exclusively this type of fishing. Practically three-fifths of the yearly catch is obtained just off the South coast during the late winter or early spring, or from January to April. The figures below show the yearly output of salted and dried cod, recalculated into dry weight, during the years 1925-1929:

1925.....	51,000 tons	1927.....	50,500 tons
1926.....	38,000 "	1928.....	65,600 "
1929.....	66,700 tons		

In fresh fish weight the above figures are equivalent to 246,000 tons for 1928 and 250,000 tons for 1929, or about 2.5 tons per individual of the population. In addition to these quantities, fresh iced fish was sold to England at a value of approximately three million crowns (the Icelandic crown is the equivalent of 26.8 cents) in each of the years 1928 and 1929.

The total catch has increased constantly from year to year. In 1913, for instance, the total weight of the catch of cod, fresh, without head, gutted and split, was 99,667 tons; in 1917, 61,013 tons; and in 1922, 89,643 tons. Still greater quantities have been caught in more recent years.

With regard to the type of boats used, the general tendency has for some time pointed toward an emphasis upon trawlers as against vessels of other types, and the quantities of cod brought in by trawlers have been increasing up to very recently. One notable exception was the period during the World War when, due to the tremendous prices that tonnage of

all kinds fetched, the Icelanders sold ten trawlers, or approximately half of their trawler fleet. In 1913 trawlers brought in about 13,000 tons of cod, in 1916 about 19,000 tons, and in 1922 about 37,000 tons. In 1927 and 1928 the catches brought in by trawlers consisted of approximately 26,000 tons for each year, and in 1929 the total was only about 20,500 tons. The low figure of 1929 was due primarily to a strike that lasted about two months. Notwithstanding the fact that both these drops can be accounted for rather satisfactorily, there has nevertheless been a gradual decline in the quantity brought in by trawlers in recent years, although the entire catch by boats of all types has increased considerably. The following figures indicate, in approximate percentages of total yield, the quantities caught by trawlers in selected years:

1920.....	30%	1927.....	50%
1921.....	37%	1928.....	33%
1922.....	40%	1929.....	30%

Only one vessel was added to the steam trawler fleet in 1929, while several boats were added to the fleet of smaller steam vessels and motor boats. The present trend, then, points toward an increase in the number of decked vessels in preference to open boats, but not necessarily toward additional acquisition of steam trawlers. Decked motor vessels are preferable to other kinds because of the saving in bunker space and labor that they entail, as well as their general suitability to fishing. The overhead of a trawler is relatively larger in proportion to its earning capacity than that of a motor vessel. In the year 1922 the crews of Icelandic trawlers averaged 26 men, of steam ships 17.3 men, of sailing vessels 13.4 men, of large



motor vessels 11.2 men, of small-sized motor boats 5.4 men, and of rowing boats 4.3 men. In the same year the average catch of cod by different types of boats was as follows:



FIGURE 8.—An old house in Reykjavik, roofed with turf and buttressed with rock. (Courtesy of the Danish Consulate.)

	<i>Tons</i>
Trawlers .....	1,210
Deck vessels (trawlers excepted) .....	114
Motor boats .....	64
Rowing boats .....	13

The bulk of the cod landed in Iceland is intended for export and is generally shipped fully cured, although smaller quantities are often sent half-cured or only fully-salted. The fully-salted cod is washed and then sun dried. In recent years modern fish curing plants have been erected along the coast in which the cod is cured artificially. These plants have been established in order to make possible the curing of cod even during the winter months when the inclement weather prevents curing out of doors.

The export of dried and salted codfish amounted to 84,000 tons in 1928 and 82,000 tons in 1929. Although the export figures for 1929 show a decrease of 2,000 tons when compared with those of 1928, the total catch

was nevertheless greater in 1929, the domestic market absorbing a larger quantity than previously. In 1923 the total export of fish was 59,464 tons, valued at 37,200,000 crowns. The distribution of the quantity and the value of the fish exported to the different countries in that year are shown in the following table:

	<i>Tons</i>	<i>Value in Million Crowns</i>
Spain .....	24,393	19.2
Great Britain .....	16,098	7.7
Italy .....	10,662	5.4
Denmark .....	6,699	4.0
Portugal .....	1,047	0.6
All other countries .....	567	0.3

The great increase in the production of dried cod in recent years has forced exporters to look for new markets. As a result the exports to Portugal and several other countries have increased considerably and new markets have been won in South American countries, where in the past codfish of Icelandic origin was practically unknown.

From October to Christmas the trawlers pursue "ice fishing," that is, catching fish which is kept on ice and sold fresh in England. In 1928 the fresh iced fish sold in England was valued at 2,850,000 crowns, and the catch of 1929 brought 3,200,000 crowns. A large refrigerating plant on the Ottesen System was erected in the harbor of Reykjavik in 1929 for the purpose of facilitating the export of frozen fresh fish to English and other European markets, and it is to be expected that this and other improvements will stimulate this branch of the industry.

The cod fishing industry yields several by-products of which the cod liver oil is of greatest commercial significance. Cod liver oil is exported in several forms, medicinal and industrial oils being the most important. Before being shipped, all



FIGURE 9.—A typical farmstead in Iceland showing the stone-buttressed walls about the buildings. (Courtesy of Raymond & Whitcomb Co.)

oil destined to foreign markets must be inspected and classified by agents appointed by the State authorities. In 1923 the export of the commodity reached 2,865 tons, valued at 2,130,000 crowns; in 1928 the exports were 6,687,030 tons valued at 5,606,730 crowns; and in 1929, 5,095,060 tons valued at 3,264,890 crowns. The following figures show the value of the exports of the chief by-products of the cod fishing industry in selected years:

	<i>Value in Icelandic Crowns</i>		
	1923	1928	1929
Cod liver oil.....	2,130,000	5,606,730	3,264,890
Swim Bladders .....	244,000	94,460	124,290
Cod heads and bones....	47,000	120,770	142,810

### HERRING FISHING

Considerable quantities of herring are caught every year along the coast of Iceland. One species is caught in the spring and is for this reason called "spring herring"; another, the better-known "Icelandic herring," is caught in the summer during a period of eight or ten weeks beginning in the middle of July. The larger schools of this type of herring frequent the waters off the North coast of the island and the greater quantity is caught there.

The bulk of the herring is salted for export, though some is spiced or

pickled. In 1923 salted herring valued at 5,878,680 crowns was exported, most of it going to Sweden, Iceland's chief market for both spiced and salted herring. The following table shows the total output of the herring fisheries in Iceland during the years 1926-1929:

<i>Year</i>	<i>Barrels</i>
1926 .....	245,000
1927 .....	837,000
1928 .....	682,000
1929 .....	644,000

In 1919 a law was passed providing that all shipments of herring intended for foreign markets must be accompanied by a certificate signed by a duly appointed herring sorter to the effect that the herring had been sorted as the law prescribes. If the herring is not exported within three months after being sorted, it must be sorted anew. The sorting is becoming increasingly important as more and more stress is being laid upon salting and spicing of only the very best qualities. In 1927 about 28 per cent of the catch was salted and spiced, in 1928, 25 per cent, in 1929, 20 per cent. The inferior herring is manufactured into oil and meal.

During the last decade several factories have been established for the preparation of herring oil and herring

meal. The latest of these, a large, modern oil factory, erected by the State of Siglufjord, was ready to commence operations during the season in the late summer of 1930. Since herring oil and herring meal have a much wider and surer market than the salted and spiced herring, it is to be expected that this industry will become one of considerable importance in the future.

In 1920 the value of exported herring oil amounted to 673,000 crowns, in 1923 the figure reached 1,860,044 crowns, in 1928, 2,449,220 crowns, in 1929, 2,213,080 crowns. In 1923 the herring meal exported brought to the country 1,058,000 crowns, in 1928 the export was valued at 2,709,740 crowns and in 1929 at 2,705,340 crowns.

Prior to 1900 shark fishing was carried on rather extensively, but this type of fishing is now a thing of the past. The quantities of shark liver oil produced in Iceland decreased from about 20,000 Hl. in 1900 to 564 Hl. in 1922 and the quantities produced at the present time are negligible.

The slight exodus of people from the rural sections that has taken place has primarily been a movement from inland farms to the fishing towns on the coast. These towns serve as bases for the fishing fleets and places where the fish is cured and the oil stored before being shipped to the markets. In 1880, 12 per cent of the total population depended upon fishing for a living, in 1901, 11 per cent and in 1922, 22 per cent. The town or city population increased from 5 per cent of the total in 1881 to 34.2 per cent in 1924.

#### MANUFACTURING

There were few manufacturing industries worthy of that name in Ice-

land before 1900, although handicraft trades existed as far back as 880 A. D. Forty years ago Iceland's so-called industries employed about 2 per cent of the population, while in 1920 they provided a living for 12 per cent. This larger number of industrial laborers has found employment chiefly in the establishments that are closely connected with or dependent upon the fisheries. The number of people working at the handicrafts or in the domestic industries is steadily decreasing, which is the natural result when a country is becoming industrialized, even if the process is slow.

In the past almost all of Iceland's wool was made into woolen goods, especially hosiery and mittens, which were then exported in considerable quantities. Today practically all the raw wool is exported and large quantities of ready-made clothes and underwear are imported. Lately attempts have been made to encourage the manufacturing of woolens for which the country's resources in wool, and as yet poorly developed water power, hold great possibilities for future development. It was in the woolen mill "Alafoss," located just outside Reykjavik, that the water from the hot springs was first used for industrial purposes. Pipes are laid from the springs directly to the mill and the water is used both in processes of manufacturing and for heating the buildings. That the savings thereby are considerable is easily realized.

As has been mentioned, the manufacturing of margarine is becoming an industry of increasing importance and will no doubt continue to expand from year to year.

The only factories for export in Iceland are those for the preparation

of fish oil and fish meal. There are about a dozen such plants of which "Aegir" in Krossanes has the largest output and an annual turnover of several million crowns. The activities of the other firms are on a very much smaller scale.

In addition to these industries, several other smaller establishments cater to the needs of the domestic shops and households. Their most important products are fishing nets, wooden oil barrels, soft drinks, and foodstuffs. There is a shipyard in Reykjavik, but the few new ships that are built are mostly small fishing boats.

#### CONCLUSION

Icelandic agriculture is predominantly extensive and must, no doubt, because of the climate and the soil, largely remain so also in the future. From earliest times this industry has provided a living for the greater part of the population and still employs a larger number of people than any other single occupation.

The fishing industry has gained in



FIGURE 10.—A pony pack in Reykjavik. These sturdy ponies, known for their strength and endurance, constitute an important item of export from Iceland. (Courtesy of Raymond & Whitcomb Co.)

importance in recent years and the present situation seems to indicate that the progress will continue in the future. Cod fishing ranks first, with herring fishing second. Products of the fisheries constitute the major portion of Iceland's relatively large volume of exports.

At present few factories flourish in Iceland, but utilization of the country's potential water power and an expanded domestic market in the future will no doubt bring about the establishment of additional enterprises.

## MECHANIZATION OF AGRICULTURE IN U. S. S. R.<sup>1</sup>

*Frances M. Earle*

**E**XAMINATION of the various phases of the Russian plan of economic development illustrates in a striking manner that socialization of industry, reorganization and mechanization of agriculture, and the development and maintenance of a favorable balance of trade are so closely interrelated as to be practically inseparable. This plan has for its first object the rapid development of heavy industries thereby ensuring the further development of other branches of industry, and, second, agricultural reorganization by means of state and collective farms which will be mechanized. The development of productive forces along lines prescribed in the plan is expected ultimately to transform a backward agricultural country into an industrial power second to none of the most highly developed countries of the western world.

### INDUSTRIAL ASPIRATIONS

In the decade preceding the war Russia experienced a period of remarkable industrial growth accomplished mainly by foreign initiative and investment. During the war many of the existing factories were dismantled, wrecked, or driven so ruthlessly that machinery was badly damaged in consequence. War was followed by revolution and revolution by famine. For a number of years little attention could be given

<sup>1</sup> Most of the figures used in this article are taken from official U. S. S. R. sources, or are quoted directly from interviews with managers of state farms, factories, and collectives. While reasonable care has been used in selection, no responsibility is assumed for the accuracy of the statistics.

to anything beyond sheer self-preservation.

With the coming of better times, however, industrial hopes began to rise. The expansion and modernization of pre-war industrial plants, now nationalized, formed the foundation upon which the State began to build a more complex industrial system. Industrialization, which in other countries would normally occupy many years, is here being crowded into a very short period. Dozens of new projects are in progress. The financing of these large-scale enterprises has been a major concern of the State, and a large share of the national income has been lavished upon them.

### FOREIGN TRADE

The simple national economy of Russia is reflected in an analysis of foreign trade. For twenty years prior to the World War products of extractive industries constituted the larger part of total exports while imports were largely manufactured goods. With slight change of emphasis the situation remains practically the same. A larger share of imports are classified as producers' goods, but agricultural products still account for more than 50 per cent of exports. The maintenance and expansion of foreign trade is therefore dependent largely upon an exportable surplus of agricultural products. Existing financial conditions make the expansion of foreign trade a prerequisite to success in the industrial program.

It is generally recognized that



prior to the war Russia was exporting to the maximum capacity. Then, as now, it was an open question as to whether the reported exports of grain could be justified in view of the general economic situation in the country. The Sixteenth Party Congress, however, passed resolutions approving "The forcing of exports by the accelerated development of a number

grown by the average bedniak was for "subsistence" in the narrowest sense of that much-misused term. Grain moved from field to home granary to local grinding mill and then back to the cottage flour barrel. And the barrel was often empty before the next harvest came round.

As a result the bedniak was of scant importance to the national

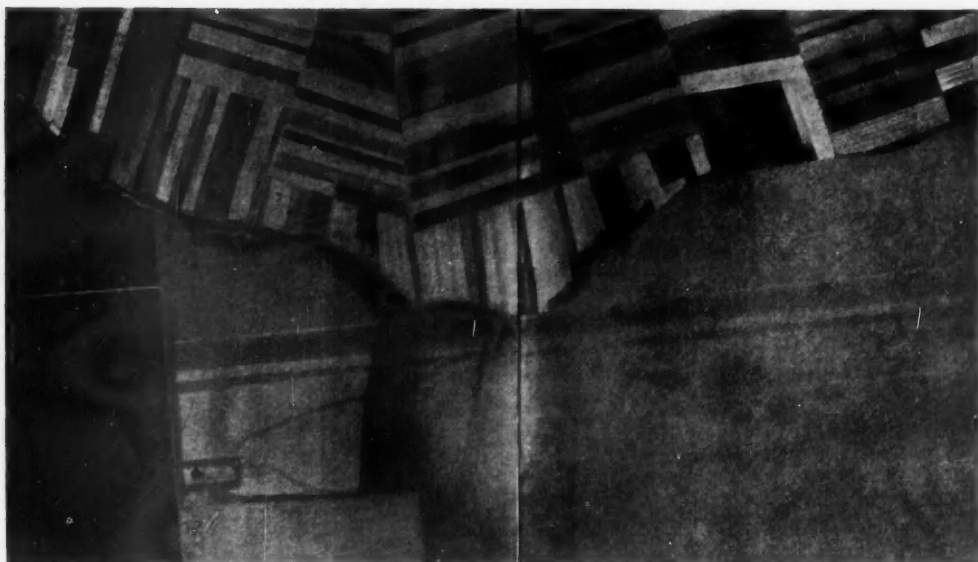


FIGURE 1.—The new collective methods of farming are changing the face of the Soviet lands. Air view, showing unbroken stretch of land held and cultivated by collective farm adjoining individualist holdings. (Courtesy of "U. S. S. R. in Construction.")

of branches of industry and agriculture working for the export market."

#### PEASANT AGRICULTURE

Russia has been recognized as a country of great agricultural potentialities. It was for generations a land of large estates worked by serfs under a system of absentee landlordism. After the abolition of serfdom in 1861, the land was divided and peasants acquired small tracts. The holdings of many peasants were too small to supply actual needs; their equipment was poor and their methods primitive. The wheat or rye

grain trade. Prior to 1914 small holders sold only about 14 per cent of their total crop. The well-to-do peasants, now called "kulaks," and the landlords of the great estates supplied the grain surplus which led all other Russian exports.

Following the war estates were broken up and land still further subdivided, and it is significant that the number of small holdings increased from 15 to nearly 25 million.

The peasant problem has always been a pivotal point in Russian national life. Out of a total population of 154 million fully 80 per cent are

peasants. As yet probably 60 to 75 per cent of this peasant population is carrying on agriculture in the traditional manner. Low productivity inevitably results from primitive methods, lack of proper equipment, and the acute shortage of horses and other draft animals. In many areas only crude wooden implements are available and human labor is employed almost exclusively. It was officially stated that in 1929-1930 two-thirds of the grain area was sown by individual peasants—bedniaks whose average marketable surplus was small.

#### LIQUIDATION OF THE KULAKS; DECLINE OF GRAIN SURPLUS

With the surplus-producing estates broken up, and the bedniak supplying only himself, the government might still have counted upon a grain surplus from the so-called "kulaks." This class, however, was soon marked for extermination as inimical to the new social order. From revolutionary days the government has carried on a continual struggle with the more prosperous land-owning peasants. The kulaks were successful individualists and as such stood in the way of complete socialization. As a result the State finally determined upon their "liquidation." They have been dispossessed of lands, implements, and livestock, and thousands are said to have been deported to other parts of the U. S. S. R. to work as laborers on state projects. With the liquidation of the kulaks as a class, the marketable surplus of grain practically ceased.

With their tiny landholdings divided into uneconomic strips and with ineffectual methods, peasants could do little more than sustain themselves. Small-scale agriculture



FIGURE 2.—The State receives a share of the grain produced on collective farms. (Courtesy of "U. S. S. R. in Construction.")

soon came into conflict with large-scale industrial development and the planned economy of the entire Union. Production was entirely inadequate to supply the growing demands of an increasing urban population and to furnish a marketable surplus. Under these conditions the government, keenly desirous of again entering the international grain trade, was literally forced to enter the agricultural business. With their inherent leaning toward large-scale methods, Russian officials visioned a completely remade agricultural economy, with giant machinery to do the work and a flood of cheap grain available for export. In the final analysis that meant the adoption of new methods calculated, first, to grow grain on a large scale, and, second, to place that grain under the direct control of the government so that it might be easily used for the establishment of foreign credits.



FIGURE 3.—Old-fashioned methods of thrashing grain still obtain in many collectives. (Courtesy of "U. S. S. R. in Construction.")

#### NEW MECHANIZATION PROGRAM

In his report to the Sixteenth Party Congress Stalin wrote as follows:<sup>2</sup>

"But to settle the grain problem, and thereby bring agriculture into the way of a serious improvement, means to liquidate the backwardness of agriculture at its very roots, arm it with tractors and agricultural machinery, equip it with a new personnel of scientific workers, raise the productivity of labour, and increase its commercial effectiveness. Without these conditions it is no use dreaming of solving the grain problem."

Recognizing the inability of petty peasant farmers to master the new technique and to increase the productivity of labor, he stated that the only solution of the agricultural problem is in the creation of large Soviet and collective farms "armed with

modern technique." In adopting the report, Congress gave its approval to the "development in every possible way of the mechanization and tractorization of agriculture, the fulfillment of the Five-Year Plan of Soviet Farm construction in three years, the building up of a firm mechanical and tractor basis for the wholesale collectivization of peasant farms throughout the U. S. S. R."<sup>3</sup>

After the crisis of 1928, a vigorous campaign was initiated toward co-operative and mechanized agriculture. The amalgamation of many thousands of petty peasant holdings into large collective farms was designed to serve a double purpose: first, the production of surplus grain for the export market and, second, the elimination as rapidly as possible of the property-owning individualist

<sup>2</sup> Stalin, J., "Political Report to the Sixteenth Party Congress of the Russian Communist Party," p. 206, Modern Books, Ltd., London, 1930.

<sup>3</sup> *Ibid.*, p. 207.

in agriculture. State farms, modeled in the beginning after large American and Canadian farms, were designed primarily as grain producers. Certain of them had an additional function—that of an experiment station and training center. It was also expected that eventually they would serve the purpose of directing peasants into collectives.

#### THE SOVHOZ PLAN

The term "Sovhoz," Soviet farm, was originally applied to large-scale

tation are in the North Caucasus, the steppes of southern Ukraine, Middle and Lower Volga lands, in the Urals and Bashkir Republic, and the southwestern part of Siberia. Most of these lands lie in drought and semi-drought areas, so the development program calls for deep tractor ploughing plus the use of drought-resistant seed.

Toward the financing of the Sovhozy the State contributed 65.7 million rubles in 1927-1928, which was increased to 856.2 million in



FIGURE 4.—A section of "Selmashstroy," at Rostov. "Selmashstroy" manufactures many types of agricultural machinery. (Courtesy of Press Cliche.)

state enterprises of several types, such as grain, flax, beet, and cotton, but usage has since tended to restrict the term to grain farms, sometimes called "grain factories." The program as adopted called for the organization of a number of these farms during the first three or four years and it was estimated that they could produce 100 million poods (1.6 million tons) of marketable grain by the end of the five-year period.

Since the Sovhozy were restricted to land not already under cultivation, including tracts in the virgin steppes of southern and southeastern Russia, these farms have already effected a great increase in cultivated acreage. The chief centers of opera-

tion are in the North Caucasus, the steppes of southern Ukraine, Middle and Lower Volga lands, in the Urals and Bashkir Republic, and the southwestern part of Siberia. Most of these lands lie in drought and semi-drought areas, so the development program calls for deep tractor ploughing plus the use of drought-resistant seed.

1929-1930. It has also supplied 18,000 tractors and 1,600 combines during that period. The result has been a remarkable increase in the area sown and in output of grain available for market. Gross output increased from 9.5 to 28.2 million cwt., while the quantity marketed increased from 6.4 to 18 million cwt.<sup>4</sup>

The grain produced on Soviet farms is selected and graded and therefore commands a higher price than that grown by individual peasants on their small holdings. A large share of the best grain is held for seed and distributed to collectives and peasants. State farms operating over large tracts of land and equipped

<sup>4</sup>Stalin, J., cited, p. 60.



with modern machinery not only have a higher average yield but also reduce the unit cost of production by applying the economies of large-scale methods. It is difficult to determine accurately cost of production in view of the prevailing system of cost accounting, but already there are sufficient data to indicate rather conclusively that under proper management grain can be grown more cheaply on state farms than by individual peasants. The November 1, 1930 issue of the London *Economist* states that on the Gigant farm the yield in 1929 was 54 poods

varies from 20,000 to 60,000 hectares, but Gigant with its 180,000 hectares has been developed on a spectacular scale to serve as the show place for the entire Sovhoz movement. This amazing project, much advertised as the largest farm in the world, lies in the flat plain of the North Caucasus some 148 kilometers from Rostov-on-the-Don. Here on the treeless steppes a central "factory" housing some 17,000 persons has been laid out, with neat concrete buildings like huge military barracks, and all the services needed by any community of that size.



FIGURE 5.—Thrashing on a state grain farm in the Ural region. The sheaves are being brought on an automobile which on its return journey takes the thrashed grain.

per hectare and, in 1930, 65 poods, in contrast to the peasants' average yield of 40 and 42 poods per hectare respectively. It is too early to determine whether the enormous investment in Sovhoz is economically sound. Expenditures are increasing steadily and, in view of the low revenue derived from agricultural lands owned by the State, it is an open question as to whether they can pay an adequate return upon the capital invested.

### *Gigant*

Two of the most interesting of these Sovhozy are "Gigant" (The Giant) and "Verblud" (The Camel). The area of most of the state farms

Gigant, according to its Manager, employs 2,500 laborers the year round, in addition to 4,000 others for seasonal work. All operations have been completely mechanized. The equipment of the farms includes hundreds of plows, harrows, seeders, cultivators, rakes, and miscellaneous equipment, all pulled by tractors, generally of the powerful caterpillar type. Harvesting is done by means of a fleet of over 200 American combines. With its grain warehouses, machine sheds, forges, and repair shops, Gigant represents the most impressive single agricultural colony of what the Soviet hopes to make a national movement.

During the 1930 season Gigant





FIGURE 6.—On a state grain farm in Northern Caucasus. Tractor pulling four drills which were made in Russia. (Courtesy of Press Cliche.)

produced in round numbers 3,000,000 bushels of wheat and 1,000,000 bushels of rye; ambitious plans have been laid for future increases in acreage sown. Among the pressing problems which must be solved is a shortage of labor skilled in the handling of complicated machinery. Operation costs at present are therefore higher than they will necessarily be in the future. With its virgin soil, however, there is no question of fertilizer expense, and it is claimed that rotation will not be needed for at least five years.

#### *Verblud*

The development of Verblud, while on a smaller scale, is probably of far greater significance. Located some 60 kilometers from Rostov in a dry-farming area, this "grain factory" is producing both spring and winter wheat. Like Gigant, it is equipped with a variety of machinery, including sufficient tractors and combines for all field work. This year's harvest totaled about 1,000,000 bushels of wheat and rye combined, raised on about one-sixth of its total acreage.

The prime significance of Verblud, however, lies in the fact that it has been constructed to serve as an experiment station and training school. The experimental farm employs 77 technicians, including engineers,

agronomists, and statisticians; its work falls into three departments—machine testing, farm management, and agronomy. The training school has a staff of 71 instructors and more than 500 students, all of whom have previously been factory workers with no theoretical training. A two-year course is given, combining theory and practice, in order to train agricultural men of the practical engineering type as quickly as possible. The central idea of Verblud is to combine in the most effective way large-scale production of grain, personnel training, and scientific experimentation. Because of the two latter phases of its work, the capital investment has necessarily been heavy, but opinion among investigators is practically unanimous that this is by far the best managed of all the Sovhozy.

#### THE COLLECTIVES

The progress of the collectives has been in some ways as spectacular as that of the state farms. Under the collective system peasants in a given locality pool their land in one large holding, which is thereafter run coöperatively for the benefit of all members. Machinery and livestock are held in common, and all members of the collective theoretically contribute an equal amount of labor. The various agricultural op-



FIGURE 7.—Harvesting grain on Gigant State Farm, July, 1930.

erations are carried on under the direction of skilled leaders, the harvest is stored in a common granary and then distributed according to a predetermined plan *after* the government has been permitted to take part of the crop for export. This provision is indeed the kernel of the entire collective system so far as the government is concerned.

The State has offered many attractive inducements to help draw the peasants into collectives. Tractors and combines are provided, as well as training and instruction in scientific methods. The poorer *bedniaks*—those with the smallest holdings, the most infertile soil, and little equipment or other property—joined the collectives gladly in the hope of improving their economic position. The well-to-do peasants naturally held back, feeling that they had more to lose than to gain. Governmental pressure was sometimes brought to bear upon reluctant members of the community, thus forcing them into the new organization. In many cases livestock was slaughtered in preference to turning it into the collective herd, so that parts of the U. S. S. R. are today seriously understocked with animals. In spite of a certain amount of resistance the movement has progressed steadily. The Commissariat of Agriculture recently re-

ported (in *Izvestia*) that on April 1, 1931, 42 per cent of peasant households have already become members of collective farms. The movement has been most successful in the Volga-German Republic, North Caucasus, Crimea, and Lower Volga Region.

The last official report of the Central Committee showed that property of the liquidated kulaks, with a value of more than 400 million rubles, had been transferred to the collective farms. During the three-year period, 1927–1930, the State provided 719 million rubles for financing and made other grants and rebates which greatly strengthened their position. It has also furnished the collectives approximately 30,000 tractors in addition to 7,000 held in a so-called Tractor-Center. Improved seed has been issued. In order to minimize unskilled management, the State has rendered aid in matters of organization. Under these conditions some extraordinary results have already been obtained. The area sown in collectives increased from 800,000 hectares in 1927 to 36 million hectares in 1930. A corresponding increase in production is claimed. The gross output of grain on collective farms in 1927 was 4.9 million cwt., and in 1930 was given as 256 million cwt. Of this amount more than one-third was

available for sale, in contrast to the former marketable surplus of about 11 per cent from peasant sources.

### *Tractor Stations*

As already indicated 60 to 75 per cent of peasants are still individualist farmers. Under Soviet plans, however, individual farms will be superceded ultimately by state and collective operations. In the meantime it is desirable that the State render certain aid to small holders in order to ensure a continued supply of grain

radius or more. By removing boundaries between small plots and increasing the sown acreage, the tractor is expected to act as an entering wedge for complete collectivization.

### *Tractors and Farm Machinery*

The ratio of mechanical power to human labor has always been low in Russia, but the Government is trying to improve this condition both by building and buying quantities of agricultural machinery. Paul Haensel in his "The Economic Policy of Soviet Russia" states that



FIGURE 8.—Collective farm in the Orenburg district receives eight Caterpillar tractors with agricultural implements. Tractor column on its way to the collective farm.

from that source. Efforts are being made to teach better methods and to increase the use of improved seed and fertilizers. Financial aid has been given and provision is being made in certain localities for the establishment of service stations. Machine tractor stations were tried out near Odessa three years ago and since that time about 200 such stations have been established. Their function is to supply tractors, ploughs, threshers, and other needed machinery on contract to groups of peasants who do the work. A tractor station usually has from 50 to 200 tractors and serves an area of fifteen kilometer

34 per cent of peasant farms are said to have had no tilling implements whatever in 1927. About 2 per cent of the total area under cultivation was tilled by tractors in 1928. In 1928-1929 the foreign purchases of farm machinery and tractors were valued at 43.4 million rubles. In order to achieve self-sufficiency as rapidly as possible, every effort is being made to supplant imports by increasing local production. More than 190 million rubles has been allotted to the manufacture of agricultural machinery during the five-year period. Existing plants have been rebuilt and enlarged and new

plants are under construction at Kharkov and in the Urals. Urgent need hastened the completion of a factory in Stalingrad which is now turning out a small number of tractors; full capacity of this plant is estimated at 50,000 tractors per year. The Putiloff Metal Works in Leningrad has recently added tractors to its list of products. This plant produced its first tractors in 1924. The output was five tractors at a unit cost of 6,500 rubles; in 1929-1930 output had increased to 12,000 tractors and the cost reduced to 2,550 rubles each. Under the government program output will be increased to 25,000 tractors per year and 60,000 sets of spare parts. In the beginning, 50 per cent of the machines turned out by the Putiloff Works were returned as unsatisfactory whereas it is claimed that now only 1 in 1,000 comes back. At Stalingrad and other factories a large percentage of the tractors are found to be defective.

The Rostov Agricultural Machinery Works, better known as "Sel-mashstroy," was completed in June, 1930. In addition to tractors this plant makes peasant carts, horse rakes, seeders, disc harrows, tractor plows, mowers, and binders. To aid in supplying the demand for skilled labor a school is maintained which gives technical training to about 500 persons at a time. Persons so trained are expected to later enter the factory, where there are already ten thousand employees. Towns spring up around the factory as a center, since plants are often located in previously undeveloped areas. The influx of labor to such a newly developed area requires a large investment in housing, educational, and recreational facilities.

#### AN AGRICULTURAL EXPERIMENT

It is impossible at this time to estimate the final results of this sweeping program for the reorganization of agriculture. It is unlikely that mechanization, even if carried to the extent contemplated under the Five-Year Plan, will justify all the claims which are being made by its more enthusiastic proponents. On the other hand, the new movement has unquestionably stimulated farming methods all along the line. In the face of world overproduction, Russia exported over 40 million bushels of wheat in 1930, and was credited with having an additional 70 million bushels available for export.

With its great extent of plains land, only a small percentage of which is yet under cultivation, the U. S. S. R. is well situated to carry on such an experiment in the application of modern science and mass production methods to agriculture. The land itself has been nationalized and with the additional nationalization of industry and government monopoly of foreign trade—vital links in the chain of a planned national economy—it is possible to concentrate upon the mechanization of agriculture.

Modern machinery has been steadily forthcoming—in fact, machinery has been introduced much faster than men could be trained to handle it. Anxious to make an impressive showing at once, many thousands of dollars' worth of expensive equipment has been badly damaged, or worn out before its time. The shortage of technical experts is being remedied somewhat by the use of foreign specialists, and by sending selected men abroad for technical training. Special attention is being paid to the training of young workers.

None of the numerous problems are necessarily permanent; most of them can be remedied in time. The new agriculture is already many times as efficient as any other type known to the peasant. State farms such as Verblud, which is experiment station, demonstration plot, and training school in one, are acting as

a leaven to spread the gospel of new and better methods throughout the land. Thus, mechanization, a farming experiment on a scale which can only be described as colossal, will undoubtedly have a profound effect upon the entire economic and social life of the U. S. S. R. and upon its national development.



## SAN LUIS OBISPO, CALIFORNIA<sup>1</sup>

*John Wesley Coulter*

SAN LUIS OBISPO, a city of about 7,000 people, is situated about midway between San Francisco and Los Angeles on the Southern Pacific Railway, some five miles south of Cuesta Pass through the main ridge of the Santa Lucia Mountains (Fig. 1). Towards the north and east is mountainous grazing country; a dairy farming district lies to the northwest; to the south is an area of general farming. The city owes a considerable portion of its activities to trade with the surrounding country, especially with the general farming district to the south and the dairying district to the northwest. Among the activities closely related to the conditions of the surrounding country, the retailing and wholesaling of supplies of all kinds are of great importance. There is also an important butter-manufacturing industry based upon the supply of cream from farms in nearby areas. San Luis Obispo is the seat of the county of the same name and therefore the center of local political and governmental activities. It is, furthermore, an important educational and recreational center. San Luis Obispo would not, however, have attained its present size and importance were it not for highly significant relationships to places and conditions many miles distant. The city is an important division point

on the coast line of the Southern Pacific Railway, and has important car repair shops for that railroad. It is the headquarters of the Pacific Coast Railway, a narrow gauge line operating in a rich agricultural country between Port San Luis and Los Olivos in Santa Barbara County, which adjoins San Luis Obispo County on the south. The situation of San Luis Obispo near the coast on the route of a pipeline between oil fields in the San Joaquin Valley and Port San Luis, the shipping point for oil from those fields, has caused it to be an important local headquarters for the Union Oil Company. Finally, San Luis Obispo is located on the coast highway between San Francisco and Los Angeles, and has a considerable hotel business supported by tourists traveling between those cities. These varied activities have all contributed to the growth and importance of the city and they have operated to make it a place of interesting and varied relationships.

In San Luis Obispo, the old and the new mingle. The flavor of the past centers around the old adobe mission (Fig. 2), once the center of the life of the settlement. A block from the mission, "Chinatown," continues as the dilapidated remains of a larger Chinese settlement. Some of the houses of the old town close around the mission are constructed in part of adobe and are quaint reminders of the past. The new order is represented by modern hotels, large garages, stores and shops, electric lights, paved streets, and a beautiful residential district.

<sup>1</sup> This study is part of a study of a larger area, a summary of which appeared in *The Geographical Review* under the title, "Land Utilization in the Santa Lucia Region." (*Geog. Review*, Vol. XX, July, 1930, pp. 469-479.) The geography of San Luis Obispo is based almost entirely on field work done during the summer of 1925.



FIGURE 1.—The position of San Luis Obispo in the hills back from the coast, roughly half way between San Francisco and Los Angeles.

The "lay-out" of San Luis Obispo is closely related to the physical characteristics of its site (Fig. 3). The city occupies an area of smooth to slightly rolling land lying between the southwestern base of the Santa Lucia Range and several outlying hills near the mountains. San Luis Creek, which rises in the main range, flows southwestward across this relatively level area and passes out between two of the hills. Much of the city is built upon alluvium and stream gravels deposited by San Luis Creek and a small tributary which joins it from the north. The bare, rocky mass of Cerro San Luis Obispo rises abruptly more than 1,000 feet above the western edge of the city precluding further expansion in that direction (Fig. 3). To the southeast, the growth of the city has been restricted by Terrace Hill, which rises several hundred feet above the floor of the valley.

The streets of San Luis Obispo seem also to be related to conditions

of the site and to the approaches to the city. Instead of following north-south and east-west directions, as do the streets in most American cities, they have a diagonal trend, though they are at right angles to one another for the most part (Fig. 3). This arrangement is unquestionably an adjustment, at least in part, to the direction of the principal approaches to the city. The first route across the site of the city was the El Camino Real, the old highway which connected the Spanish Missions in California, and on which was situated Mission San Luis Obispo, the nucleus of the city. The old road entered the plain of the city from the southwest along the narrow strip of lowland between Cerro San Luis Obispo and the next hill mass to the southeast; to the northeast, the road followed up the valley of San Luis Obispo Creek in ascending to Cuesta Pass. The other approaches to the city are also diagonal, since they follow the trend of the lowland at the base of the range.

The location of the principal business district (Fig. 4) is an adjustment to the needs of travelers on the main traffic artery through the city. This artery, Monterey Street, is the principal business thoroughfare, and is characterized by stores, banks, restaurants, offices, hotels, garages, and the various other places of business commonly found in a town of this size. A second important business street, Higuera Street (Fig. 4), parallels Monterey Street a block to the southeast and is characterized by similar types of business houses. Twelve garages and eighteen gasoline stations in many cases occupy corner lots on the two main business streets.

The three creameries of San Luis Obispo are located together just



FIGURE 2.—The Old Mission of San Luis Obispo, established in 1772, was for years the center of life and activity in the community. (Courtesy of Frank Aston.)

beyond the southwestern end of the business district, in such a position as to be convenient to farmers bringing in milk and cream and at the same time so placed as to interfere but little with regular street traffic. The only other manufacturing establishment in the city worthy of note is a brickmaking plant; this is situated near the southeastern corner of the city on the Edna Road.

As indicated on the accompanying map (Fig. 4), residential sections occupy most of the city and extend varying distances in all directions from the central business district. Some of the houses are stuccoed and a few are of brick, but for the most part they are of frame construction. The oldest residential area is that nearest the mission (Fig. 4). The highest class residential area is in the newer, northeastern part of the city, where the land is higher than in other parts (Figs. 3 and 5). The least desirable residential section is in the extreme northwest; there the land is rocky and hilly and the houses are small and dilapidated. In general, the homes in the southeastern portion

of the city, near the Southern Pacific Railway, are not so neat as those in other parts, and where there are gardens, they are not so well kept as are those in the better residential sections (Fig. 6).

The railroads and their appurtenances, forming a conspicuous and important feature of the city, have an arrangement closely adjusted to natural conditions. From Cuesta Pass, the Southern Pacific line approaches the city by a much more circuitous route than does the state highway, following along the irregularly broken face of the mountains in order to avoid steep grades (Fig. 3). Having descended at length to the lowland, it then follows the base of the mountains and enters the northeastern part of the city from a northwesterly direction; continuing southeastward, it skirts the eastern margin of the city, then curves southwestward along the base of Terrace Hill, and again proceeds southeastward along the valley between the main range and a line of detached hills.

The Pacific Coast Railway, coming from Port San Luis, enters the



FIGURE 3.—The relief of the San Luis Obispo neighborhood is indicated by this contour map. (Courtesy of U. S. Geological Survey.)

city at its southwestern corner through the same low gap as that followed by the state highway, skirts the southern boundary of the municipality, and leaves at the southeastern corner, where its tracks run close to those of the Southern Pacific (Figs. 3 and 4).

A number of types of buildings and plants are located in juxtaposition to the railways on account of their relation to the handling of large quantities of goods moved by rail. Two lumber yards and a planing mill adjoin the Southern Pacific a short distance to the south of the depot (Fig. 4); similarly, there are a lumber yard and planing mill near the Pacific Coast Railway just to the north of its depot. About one hundred yards south of the Southern Pacific depot along the tracks is a large cattle-loading station.

The public buildings of San Luis Obispo are situated on vantage sites or where they best serve the public for whose use they were erected. The location of the old mission chapel is of particular interest, especially as it is still a place of worship. It is on ground a little higher than that around it but close to the bank of the creek where in early days a supply of water could readily be obtained. It is sheltered by Cerro San Luis from the strong winds from the ocean which, sweeping around the base of the mountain, affect other parts of the town to the north and northeast. This was no doubt a factor of very real importance during the long period when the vineyard formed a significant part of the mission equipment. The five other churches of the city are situated in or near the most densely populated

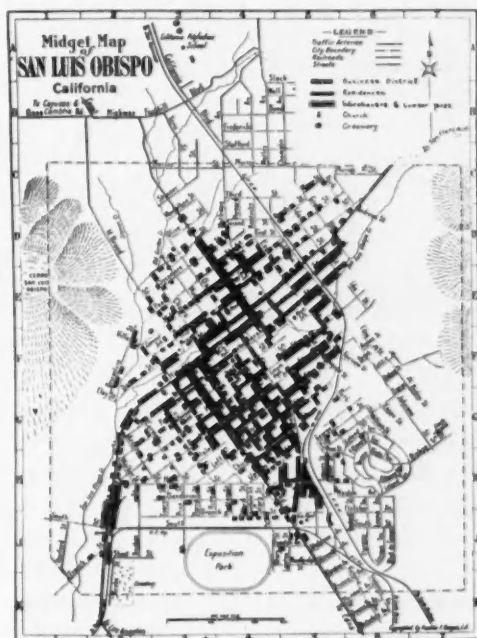


FIGURE 4.—San Luis Obispo is fairly typical of California coastal communities, its position among the hills back from the shore being a reflection of favorable physical factors.



residential section close to the southeastern part of the business district (Fig. 4). The Court House is an attractive building situated on the slope of a small hill at the northern border of the business district. The public schools are distributed throughout the residential sections of the city. The convent school is near the

periphery of the city. For example, Exposition Park is just within the southern city limits to the south of the Pacific Coast Railway, where it occupies a large area of level land at the base of one of the detached hills (Fig. 4). A new automobile camp is being constructed on the edge of the city near the northeastern entrance.



FIGURE 5.—An airplane view of San Luis Obispo. The business district is marked by high office buildings. The newer residential area is on the right center and background. (Courtesy of Frank Aston.)

mission. The California Polytechnic High School is half a mile north of the city boundary, where land is available for practical work in agriculture. Of the public utilities structures, the most conspicuous are those of the gas works. These are situated in the southeastern part of the city between the railroads.

Public grounds of various kinds are located for the most part on the

Merchandising is an outstanding economic activity of San Luis Obispo. A portion of this trade is based upon the needs of the people of the town, but some of it is concerned with the provision of goods for those passing through the town, and probably most of it is with the people of the surrounding country and the villages and towns within a radius of about twenty-five miles. Especially prom-



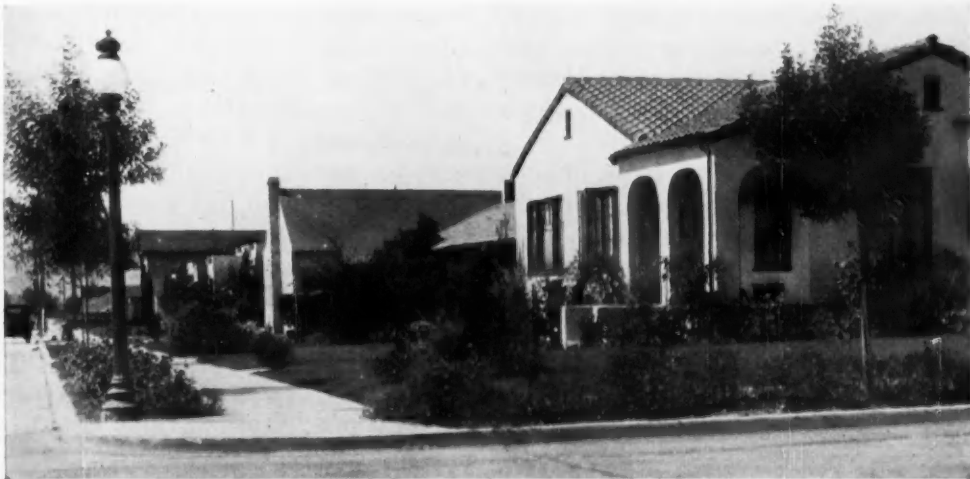


FIGURE 6.—Typical homes in the better residential district of San Luis Obispo. (Courtesy of Frank Aston.)

inent among the business houses are those which do not specialize in any single class of commodity but which sell a wide variety of general merchandise.

The importance of the trade of San Luis Obispo with the general farming district to the south is perhaps reflected in the figures on traffic in the accompanying table (Table I).

TABLE I

AUTOMOBILE TRAFFIC FIGURES FOR SAN LUIS OBISPO\*

*Vehicles Passing Auto Park North of City Limits*

All Vehicles	American Autos	Foreign Autos	
2,624	2,552	92	7-12-25
2,052	1,915	105	7-13-25
2,133	1,996	128	7-14-25
2,079	1,966	106	7-15-25
2,262	2,127	122	7-16-25
2,232	2,108	112	7-17-25
2,531	2,421	140	7-18-25
Average, 2,273 +	2,155 +	115	

*Vehicles Passing at Pacific Coast Railway Crossing, South of City Limits*

All Vehicles	American Autos	Foreign Autos	
4,445	4,312	108	7-12-25
3,162	2,899	111	7-13-25
3,254	2,992	146	7-14-25
3,409	3,190	126	7-15-25
3,401	3,145	144	7-16-25
3,095	2,823	137	7-17-25
3,662	3,384	116	7-18-25
Average, 3,489 +	3,249 +	126 +	

\* From tables furnished by the California Highway Commission. Count was taken between 6:00 a.m. and 10:00 p.m.

The average number of vehicles per day passing a point on the road at the southwestern corner of the city was 3,489, as compared with 2,273 which passed along the road toward San Francisco at the northeast corner. Most of the 1,216 vehicles indicated by the differences between these figures were probably the automobiles of farmers from the general farming districts coming to and going from San Luis Obispo. No count was taken on the road to Cayucos, Cambria, and Los Osos Valley, which leads into the dairy-farming district, nor was a count taken on the Edna Road. It is estimated by the local officers of the California Highway Commission, from whom the figures in the table were obtained, that farmers coming to "town" from these districts and returning to them would have increased the total of cars by a fourth.

Besides the retail houses which sell provisions and supplies directly to farmers and townspeople, there should be mentioned a wholesale establishment of considerable importance. Besides transactions with

local retail concerns, it does a large business with outlying towns and villages not on the Southern Pacific Railway, to whose stores and shops it delivers by truck.

In addition to the more highly fabricated commodities already noted, there is a conspicuously large



FIGURE 7.—Part of the business district of San Luis Obispo. Note the prominence of hotels and restaurants. (Courtesy of Frank Aston.)

trade in lumber and building supplies carried on for the most part by three establishments, two of which have planing mills. The lumber, used for structural purposes, is sold in San Luis Obispo and in a number of villages having no railway connections, notably Cambria, Cayucos, and Morro which are on the coast to the northwest.

There are also in San Luis Obispo a number of businesses concerned with the buying of produce from the farmers. Most of the cream from the dairying and general farming districts is sold to local creameries. There are brokers who buy grain and beans. Provision merchants buy eggs and fruit for shipment, as well as to retail to customers in town. Cattle and hogs are bought by dealers in the city who ship them to market from the local loading station. The importance of San Luis Obispo in these lines of trade is the outgrowth of its position on the Southern

Pacific Railroad only 210 miles from Los Angeles, to which it ships practically all of its agricultural produce, and of its connections by a paved state highway and good county roads with prosperous agricultural sections.

The importance of the nearby agricultural areas to the business activities of San Luis Obispo is shown by the close correlation between prosperity, or the lack of it, in city and country. During and immediately after years of heavy and well-distributed precipitation, there is much more activity in the business circles of the city than there is during and after years of subnormal or poorly distributed rainfall. Farmers have money to spend on luxuries, and their prosperity means prosperity for the business men of the city.

The banking activities of the three banks in the city are closely dependent upon the merchandising activities and upon the agricultural communities. Officers of these banks indicated to the writer that much of their business comes directly or indirectly from people engaged in farming.

The situation of San Luis Obispo on the state highway about half way between San Francisco and Los Angeles makes it a favorite "stop over" place for tourists traveling by automobile between these cities. Table I shows the large amount of automobile traffic through the city. For the week of July 12 to 18, 1925, an average of 2,155 American automobiles a day and 115 foreign automobiles passed a point just north of the city limits. Much of this traffic was probably due to tourists passing north and south along the state highway. In addition to the automobiles represented by this total, which is for the hours between 6 A.M. and

10 P.M. daily, there is a considerable amount of night travel by tourists. It is estimated that during June, July, and August, 350 tourists a night rest in the eight hotels of the city (Fig. 7). Seventy-five per cent of the hotel business of the city is tourist business, less than ten per cent of which comes by train. Though the tourist traffic is heaviest during



FIGURE 8.—Swift and Company's creamery, San Luis Obispo, where Brookfield butter is made.

the summer months, there are travelers passing north and south at all times of the year who make the city a "stop over" point.

The situation of San Luis Obispo on the state highway, midway between the two great cities of the state and with no town of considerable size near it, is responsible also for its function as an important division point for through-route automobile stages. For example, the city is division headquarters for the Pickwick stages which run between Portland and San Diego. San Luis Obispo is also headquarters for the Pickwick and other systems of stages which operate eastward to Bakersfield and other points in the San Joaquin Valley.

The great amount of automobile traffic through San Luis Obispo and the fact that many machines remain in the city overnight create the necessity of furnishing extensive garage accommodation and of

supplying fuel and oil in large quantities.

The midway position of San Luis Obispo on the coast route of the Southern Pacific Railway makes it an important division point on that line. The engines and the crews of all trains are changed there, cars are inspected, and wheels are oiled. There are railway shops in which rolling stock is repaired and a round house having a capacity of seventeen engines. Several "helper engines" are kept at the round house to assist trains across the Santa Lucia Mountains.

About 500 men living in San Luis Obispo are employed in various kinds of work for the Southern Pacific Railway. Three hundred men are employed in the local repair shops alone.

As headquarters for the Pacific Coast Railway, San Luis Obispo functions as the repairing and rebuilding center for the locomotives and cars of the line. Some thirty men are employed in connection with the operations of this railway.

San Luis Obispo, the largest city on an important pipeline system, functions as the local headquarters for the operations of the Union Oil Company. There is a double pipeline from Midway, in the San Joaquin Valley, through San Luis Obispo to Avila (Port San Luis), a distance of some 118 miles. Tributary to this double line are eighty-four miles of single pipelines. Some twenty to thirty men living in San Luis Obispo have work in connection with the oil company.

Much the most important manufacturing industry in the city is the manufacture of butter. There are three creameries within the city limits and there is another just north of the city, though the last is merely a

branch of the coöperative creamery at Harmony and is mainly an instructional plant for the California Polytechnic School. The creameries in the city are owned by three independent companies. Each, a branch plant of a larger unit operating elsewhere in the state, serves about 200 farmers.

Most of the milk and cream for the creameries comes from the dairying and general-farming districts. Farmers living near the city generally bring milk in each morning, while farmers living farther away sell cream only and deliver it to local receiving stations from which it is carried by truck to San Luis Obispo.

The combined output of the creameries amounts to about 4,000,000 pounds of butter a year (Fig. 8). It differs greatly in the wet and dry seasons, being greatest during the rainy season, when the dairy cows have abundant grass, and least toward the end of the dry season, when pasturage is scant (Fig. 9). During the season of greatest production, fifty to sixty men are employed by the three creameries within the city; only about half as many are employed during the slack season.

Practically all the butter manufactured at San Luis Obispo is marketed in Los Angeles. During the season of maximum output, some of the butter produced commonly is kept in cold storage both at the creameries and in the latter city. In addition to the manufacture of butter, one creamery makes ice cream for sale in San Luis Obispo and neighboring towns.

The only other manufacturing activity worthy of note is the making of brick. The one brick works is located near the southern margin of the city, where clay may be obtained

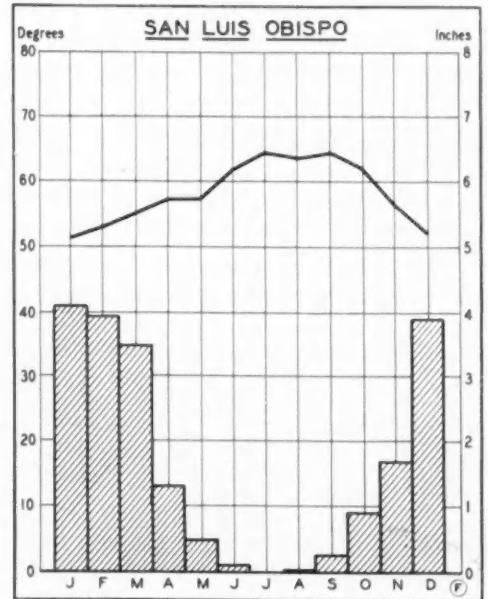


FIGURE 9.—Mean annual temperature and rainfall at San Luis Obispo.

from local deposits. About twenty men are employed. The bricks are used for building houses in San Luis Obispo and in neighboring towns.

San Luis Obispo functions in important ways in the social and political life of the surrounding country. As already noted, it is the seat of San Luis Obispo County. A county fair is held there every three or four years. It is the headquarters of the San Luis Obispo County Farm Bureau. The schools of San Luis Obispo draw students not only from the city but also from the nearby country and from more distant parts of the state as well. The public school system, consisting of two high schools and three elementary schools, employs about sixty-five teachers. There are also a convent school and the California Polytechnic High School; at the latter, instruction in agricultural subjects holds an important place. An important part of the educa-



tional system is constituted by the three libraries. The motion picture theaters and two daily newspapers having a circulation of about 3,000 each are also to be reckoned among the educational assets of the community.

Since the beginning of the century, the population of San Luis Obispo has doubled. In 1900 the population was 3,021, in 1910 it was 5,157, and in 1920 it reached 5,895. Unofficial estimates place the present population (1925) at 7,000.

The development of the city is apt to be directed along certain lines which may be predicted. For example, the residences on the central part of Marsh Street (Fig. 4) probably will be replaced by business houses; a new post office already is there. The growth of the business section is likely to occur in this direction rather than on central Palm Street (Fig. 4), which is the next street northwest of Monterey Street, because it is nearer to the main route of travel to Los Angeles and because Palm Street is objectionably close to the low-class residence district of the town. The better class residence section will probably continue to extend towards the northeast for reasons already indicated.

With the growth of the city several problems affecting the public welfare have arisen, two of which are worthy of special mention. The first of these is concerned with the position of the cattle-loading station, which, as before mentioned, is located about 100 yards south of the Southern Pacific depot on the east side of the track. The driving of stock into the corrals interferes with traffic to and from the depot and certain warehouses. More-

over, a residential section has developed so close to the cattle-loading station that the latter is objectionable to the residents. To overcome these objections, it is planned to move the stockyards about half a mile farther south where it is believed they will be just as convenient for the cattlemen as at their present location.

The other problem, and the most serious one which San Luis Obispo faces, has to do with the city water supply. The water supply municipally owned is obtained in part from wells, but chiefly from the Santa Lucia Mountains. The supply depends upon the amount and distribution of the rainfall; when heavy rains occur within short periods, much of the water runs off quickly and is lost. In a particular year, short heavy rains may occur at irregular intervals in some localities, while in nearby places, the precipitation may be more evenly distributed. Thus, towards the end of the dry season of 1924, the water-table in the vicinity of San Luis Obispo was lower than that along the coast to the northwest, owing to the difference in rainfall conditions. After a season of subnormal precipitation or towards the end of a season of prolonged drought, the situation becomes very serious because of water scarcity.

The people of San Luis Obispo have considered the possibility of increasing their water supply by building two reservoirs in Lopez Canyon, the stream of which flows into Arroyo Grande Creek. The people of Arroyo Grande, however, have Riparian rights dating from the Pismo and Santa Manuela land grants. They object to the reservoirs, since they believe they would



be deprived of water for irrigation. The people of San Luis Obispo argue, on the other hand, that should the reservoirs be built, the Arroyo Grande farmers would have more water for irrigation during

prolonged dry seasons than they now have. The problem of obtaining an adequate water supply for the city during prolonged periods of drought requires solution in the near future.

## BOOK REVIEWS

UNITED STATES DEPARTMENT OF COMMERCE  
BUREAU OF FOREIGN AND DOMESTIC COMMERCE

*Commerce Reports.* A weekly survey of foreign trade. Issued by the Bureau of Foreign and Domestic Commerce, United States Department of Commerce. Reports from representatives of Departments of Commerce and State in foreign countries, and articles prepared in the Bureau at Washington. Annual Subscription price, \$4.00.

*Survey of Current Business.* Weekly. Annual subscription, \$1.50.

In addition to figures from Government sources, there are also incorporated, for completeness of service, figures from other sources generally accepted by the trades; monthly business indicators; weekly business statistics; measures of business activity; reviews of business and industrial groups.

*Foreign Trade of the United States.* By Grace A. Witherow. Trade Information Bulletin No. 749. Price, 10 cents.

The foreign trade of the United States during 1930 reflected the severe decline in commodity prices which characterized all world markets throughout the year. Among the principal factors in the year's decline of total export values were sharp price recessions in the case of raw cotton and foodstuffs and severely contracted sales of automobiles, iron and steel products, and cotton manufactures. The wide discrepancy between the respective value and quantity declines of United States imports during 1930 was due largely to the drastic price declines in crude foodstuffs and raw material.

*Handbook on Foreign Tariffs and Import Regulations on Agricultural Products.* By Roberta P. Wakefield and Robert S. Hollingshead. Trade Promotion Series No. 114.

This bulletin rounds out the series for canned foods, and with the two previously issued (Trade Promotion Series No. 85, Canned Foods in Europe, and No. 97, Canned Foods in the Western Hemisphere) furnishes American producers and exporters with all the food laws, regulations, and tariffs applicable to canned foods in force at the dates of publication.

*American Pitch Pine and Its Uses.* By the Lumber Division in cooperation with the National Committee on Wood Utilization. Trade Promotion Series No. 119.

The foreign consumer's increasing appreciation of American woods for specific uses has made

desirable a compilation of authentic data regarding qualities and characteristics of these woods. A careful reading of this bulletin will inform the foreign consumer as to the properties and most efficient uses of pitch pine.

*Latin American Markets for Soaps and Soap Ingredients.* By E. L. Thomas. Trade Promotion Series No. 121. Price, 15 cents.

The soap industry in many of the Latin American Republics has been receiving the active support and assistance of the various governments during the past several years. This survey, which includes the major islands of the West Indies as well as Latin America, is designed to place in the possession of those interested the results of a series of studies of these markets completed within the past year by representatives of the Departments of Commerce and State.

*Guide for American Business in France.* By Thomas Butts. Trade Promotion Series No. 115. Price, 20 cents.

The French market ranks among the first five as an outlet for American goods and, as such, merits the careful consideration of exporters in this country. This study of the salient features of the legal and financial aspects of French business procedure, together with a review of the characteristics and organization of the French market, is presented in the belief that it will be of material assistance to American business men.

*Japanese Banking.* By Herbert M. Bratter. Trade Promotion Series No. 116. Price, 50 cents.

To understand Japanese finance, it is necessary to appreciate the factors which governed the gradual development of its financial organization, the influence of the wars and crises through which it has passed, and the changing financial requirements of its trade. The study has a twofold purpose: It gives a consecutive story and will serve at the same time as a work of reference.

*Taxation of Business in France.* By Mitchell B. Carroll. Trade Promotion Series No. 118. Price, 20 cents.

Perhaps no fiscal system anywhere has a greater number and variety of taxes than that of France. The tax structure is intricate and results in a cumulation of many different rates on business. Since stabilization of the franc (in June of 1928), there have been numerous reductions, particularly in taxes on securities and on earned incomes. In several instances, however, an American corporation doing business in France through a French subsidiary company has incurred twice

the liability imposed in the case of a French company deriving income from a subsidiary. This question and the essential requirements concerning important taxes on business are discussed herein. Certain minor taxes also are described briefly; but the foreigner in France may encounter still other levies which have not been mentioned in this bulletin because they do not affect the kinds of business enterprises in which Americans usually are engaged.

*The Automotive Market in Brazil.* By Howard H. Tewksbury. Trade Promotion Series No. 106. Price, 25 cents.

This report covers the automotive market of Brazil, giving in considerable detail the extent of highways, the registrations of motor vehicles, the chief distribution methods and centers, financing practices, local regulations and taxes, and other important information.

*Distribution Cost Problems of Manufacturing Confectioners.* Distribution Cost Studies No. 10.

*European Motion-Picture Industry in 1930.* Trade Information Bulletin No. 752.

*American Underwriting of Foreign Securities in 1930.* Trade Information Bulletin No. 746.

*Leather Production and Trade of Austria.* Trade Information Bulletin No. 747.

*Selling Automobiles in the Noncontiguous Territories of the United States.* Trade Information Bulletin No. 741.

*Leather Industry and Trade of Germany.* Trade Information Bulletin No. 744.

*Australia as a Market for American Goods in 1931.* Trade Information Bulletin No. 745.

*The Cotton-Goods Market of British Malaya.* Trade Information Bulletin No. 751.

*Problems of Wholesale Dry Goods Distribution.* Distribution Cost Studies No. 7.

*Legal Aspects in Collection of Accounts in Argentina.* Trade Information Bulletin No. 748.

*Retail Credit Survey, July-December, 1930.* Domestic Commerce Series No. 46.

*Small Island Markets for American Motion Pictures.* Trade Information Bulletin No. 756.

*British Chemical Developments in 1930.* Trade Information Bulletin No. 750.

*United States Tobacco and Its Markets.* Trade Information Bulletin No. 757.

*Motion Pictures in Mexico, Central America, and the Greater Antilles.* Trade Information Bulletin No. 754.

*German Chemical Developments in 1930.* Trade Information Bulletin No. 753.

*Leather Industry and Trade of Japan.* Trade Information Bulletin No. 755.

*Distribution of Dry Goods in the Gulf Southwest.* By Edward F. Gerish. Domestic Commerce Series No. 43. Price, 35 cents.

This study, the first of a series on the various phases of marketing in the Gulf Southwest, embracing seven States and constituting over 18 per cent of the total area of the United States, is divided into three distinct parts—wholesale distribution, retail distribution, and chain-store distribution, all relating to 1928. Seventy-two wholesale houses, with net sales of over \$120,000,000; 376 retail stores, with net sales of nearly \$251,000,000; and 21 chain systems, with net sales of \$162,000,000, were interviewed. It was found that the largest single item of expense for wholesale dry-goods houses operating in the Gulf Southwest was sales-force expense. One of the most striking facts brought out in relation to retail distribution is that retail stores with sales volume of less than \$250,000 had the lowest ratio of returns and allowances, while the ratio constantly increased with the increase in sales volume. Generally speaking, the ratio of cash to open-credit and installment sales depends upon the character of the population and income, and upon the prevalence of large stores catering to charge accounts and selling merchandise that lends itself to installment methods.

*Petroleum Industry of the Gulf Southwest.* By Charles B. Eliot. Domestic Commerce Series No. 44.

The petroleum industry is one of the three or four major factors, from the internal as well as the external point of view, in the growth and development of the Gulf Southwest. The development of new producing territories affects the movement of population, necessitates expansion of transportation, and communication facilities, requires changes in banking, increases the value of property, and opens up new avenues of wholesale and retail distribution of both luxuries and necessities. Production of petroleum has attracted a vast army of people to the oil fields of the Southwest. This growth in population has had a fundamental effect on rearrangement of markets and transportation. At the same time the rapid increase in capital resulting from the immense production of crude oil and refined products has revolutionized the type of market, which was formerly principally agricultural.

In view of the present unfavorable condition of the retail gasoline market, and the impracticability of an effort to include a comprehensive survey of gasoline retail outlets and marketing methods in the Gulf Southwest, the section on marketing has been confined to a discussion of the uses of the various petroleum products, their consumption within the area, shipments to other parts of the United States, and exports to foreign countries.

## BUREAU OF THE CENSUS

*The Fifteenth Census of the United States: 1930, Vol. 1, Population, Number and Distribution of Inhabitants; total population for states, counties, and townships or other minor civil divisions; for urban and rural areas, and for cities and other incorporated places.* Price, \$2.00 (Buckram).

This volume contains a United States summary, in which the population data for the several States are brought together, with comparative figures for earlier censuses. The text presented in connection with the tables has been limited for the most part to such explanations and definitions of terms as are necessary to an understanding of the statistical tables, and no attempt has been made to analyze or interpret the statistics.

*Unemployment Bulletins* have been issued for the following states: Arizona, Colorado, Connecticut, Georgia, Idaho, Iowa, Kansas, Maryland, Mississippi, Maine, Nebraska, Nevada, North Dakota, West Virginia, and Wyoming.

## BUREAU OF STANDARDS

*Bureau of Standards Journal of Research.*

Monthly, 40 cents; \$2.75 a year on subscription.

*Commercial Standards Monthly.* Subscription price, \$1.00 per year.

This new governmental periodical is a review of progress in commercial simplification and standardization.

## BUREAU OF MINES

*Mineral Resources of the United States.* Separate chapters present data on production, consumption, exports, and imports. Following chapters have been issued: Manganese and Manganiferous Ores in 1929; Sand and Gravel in 1929; Gold, Silver, Copper, Lead and Zinc in California and Oregon in 1929; Tin in 1929; Lead in 1929; Natural Gas in 1929.

HELEN M. STRONG

ORCHARD, JOHN E. *Japan's Economic Position.* xvi and 504 pages, illus., Whittlesey House, New York, 1930.

This is an outstanding study of Japan's geographic environment and economic achievements. Dr. Orchard has written a comprehensive survey of the resources of the Empire and its industrial problems.

The most vital problem facing Japan is that of securing food and livelihood for a population which is increasing at the rate of 900,000 per year in an island empire without an agricultural frontier. The production of rice is not keeping pace with the increase in population, and further additions to the acreage will be increasingly expensive. Emigration is impractical, and the only hope lies in birth control or industrialization. Until recently, the former has been regarded as

contrary to national policy, while the latter is seriously handicapped by the lack of adequate coal, iron, and oil.

The bulk of the book is devoted to a study of Japan's industrial organization and labor problems, both past and present. Consideration is given to the chief industries and manufacturing areas. The author concludes that Japan's economic structure today rests too heavily on the uncertainties of her export trade with China and the United States, both of whom have rising tariffs and an increasing industrial self-sufficiency. Because of Japan's lack of coal and iron, the West has nothing to fear from her in either a military or commercial sense. "An industrialized Orient will be not a competitor but a new market for the . . . industry of the West."

The book is interestingly written, thoroughly documented, well illustrated and attractively printed. It lacks a map. It is the book on Japan for the geographer.

GEORGE B. CRESSEY

QUENNELL, MARJORIE AND C. B. H. *A History of Everyday Things in England, 1066-1799.* In two parts, both in one volume, 208 and 208 pages; illus. Charles Scribner's Sons, New York.

"This is a History of Everyday Things in England, from the time of the Norman Conquest in 1066 down to the end of the eighteenth century, and it has been written for boys and girls of public-school age. It is an account of the work of the people, rather than the politics which guided them."—From the preface.

With this in mind, the authors have produced a reference work giving the history of customs, costumes, architecture, ships, games, and other things familiar to the English boy and girl. The book contains little of geographic interest except as these form a background for any other study. The illustrations are clearly drawn and fully explained, and the two hundred of them constitute one of the most valuable features of the book. Many a child should find pleasure and information in browsing through its pages.

PRISCILLA H. WEBSTER

*Československá Vlastivěda (Czechoslovakia In All Its Aspects).* Vol. 1, *Příroda* (The Natural Features); Vol. 9, *Technika* (The Industry). 1930-31. Sfinx-B. Janda-Publishers, Prague, Czechoslovakia.

Under the able editorship of Prof. Václav Dědina of Charles University, Prague, a monumental work of eleven volumes is planned, which will cover every aspect of Czechoslovak civilization of today. The two volumes which have appeared are the best works on the geography of Czechoslovakia that can be found in the field. Volume 1, for example, will be found valuable even by those who cannot read the Czechoslovak language. In addition to 611 splendid photographs, numerous charts and maps and statistics

can be found throughout the volume. Altogether, twenty-one collaborators, all well-known experts in their field, dealt with such subjects as the configuration of Czechoslovakia, geomorphology, landforms in arid and pseudoarid regions, the orography, the hydrography, cartography, the rocks and minerals, and the mineral wealth. Volume 9 treats most exhaustively every phase of the industrial activity of Czechoslovakia, with the exception of agriculture, for which a special volume is scheduled. Indexes, colored graphical maps, and critical bibliographies are expertly handled as in the previous volume. Those, who are used to the poor printing and binding of European books, will be pleasantly astonished to realize that both volumes compare most favorably with the best volumes prepared in this country. Both volumes will be found indispensable by those interested in Central Europe.

JOSEPH S. ROUCEK

SHELDON, CHARLES. *The Wilderness of Denali*. Explorations of a Hunter-Naturalist in Northern Alaska. With an introduction by C. Hart Merriam, Ph.D. xxv and 412 pp., 112 illustrations, and 1 folded map. Charles Scribner's Sons, New York-London, 1930. Price, \$6.00.

*The Wilderness of Denali* is an epic story of life in the region east and north of Mt. McKinley told by a big-game hunter and naturalist of repute. Sheldon entered the Alaskan interior to "study the white or Dall sheep," discovered the region frequented by these animals and lived there more than a year. His observations covered the whole range of mammals in the region but centered on the sheep, with whose habits he became thoroughly familiar. His records have filled the wide gaps in the life history of the Alaskan bighorn. Incidentally, his records of weather conditions, vegetation, and topography would appear to merit further studies of his journals.

Sheldon's unusual physical prowess enabled him to perform almost unbelievable feats day after day—climbing precipitous slopes through neck-deep snowdrifts, wading icy mountain torrents, remaining motionless for long periods with clothing soaked when stalking game—yet after his exertion of the day and often after a tramp homeward in the night, he never failed to record his experiences in his journal before retiring. It is illuminating to note that even on such occasions the day's record is likely to contain an ecstatic description of a glorious sunset, a moonlight scene, or some other of the natural beauties in which he revelled. Few men have the physical stamina to endure the rigors of such an experience; fewer of these would or could do it, unrewarded in money, for science; and only the rare individual combines with these two qualifications the ability to observe and record faithfully and to describe in vivid fashion his own tumultuously joyous emotions.

In his book, as in his life, there is much of

routine but little monotony. The author has had to contend with the problem of finding new treatments for repeated experiences. Day after day he was uplifted and awed by exquisitely colored skies or majestic *Denali, the High One*; time after time he stalked sheep, bear, or caribou, usually with success. That these experiences are still engrossing after three hundred fifty pages bespeaks a pleasing literary style.

The geographer will wish that small sketch maps had been scattered through the text and will likely find the folded map disappointing, but the photographs are uniformly excellent, carefully chosen, and effectively arranged.

No one will question the propriety of Sheldon's use of the Indian name *Denali*, but the mountain is too remote for us to make the effort necessary to bring the name into general use, unless, of course, someone with zealous and highly paid publicity agents should choose it as the locus for a spectacular stunt.

It is with regret that we must note that this is the last volume from Sheldon's pen. We have suffered an irreparable loss in the passing of this patient, modest, heroic biographer of big-game animals.

MEREDITH F. BURRILL

HANCOCK, W. K. *Australia*. viii and 326 pages. Charles Scribner's Sons, New York, 1931. Price, \$5.00.

The volume on Australia, one of the most recent additions to the "Modern World Series" of books published on selected countries of the world, like other volumes of the series, describes the economic history instead of interpreting the geography of the Commonwealth of Australia. The author, as Professor of Modern History in the University of Adelaide, naturally describes the chain of historical events that lead to the development of the modern Australian nation, but frequently fails to recognize the influence of the physical environment on certain historical facts. Only once is the geographic side of the story considered, in a brief topic under the title of "Economic Geography: The Tropics" (pp. 167-176).

In spite of the lack of geographic interpretation in the volume, there is a wealth of material assembled within its pages about a continent that possesses all too little literature concerning it. A list of the chapter headings is given in the hope that it will interest the geography student.

- Chapter 1. The Invasion of Australia
- Chapter 2. Transplanted British
- Chapter 3. Independent Australian Britons
- Chapter 4. Political Ideas and some Basic Policies
- Chapter 5. Protection
- Chapter 6. The Shifting Balance of the Constitution
- Chapter 7. State Socialism
- Chapter 8. Filling the Vast Open Spaces
- Chapter 9. Standard of Living



- Chapter 10. The Labour Party
- Chapter 11. The Parties of Resistance
- Chapter 12. Foreign Policy
- Chapter 13. Some Aspects of Society in a New Country

Chapter 14. Literature and Art

Of the chapters listed, only the first one, the "Invasion of Australia," and the eighth on "Filling the Vast Open Spaces," possess geographic qualities. In Chapter 8, much credit is deservedly given by the author to Dr. Griffith Taylor.

The book contains six full-page maps of Australia that add much to the value of the volume, but other than the six maps, no illustrations appear.

While the volume possesses comparatively little geographic value, it is a valuable reference book for the geographer and should be included in the bibliography of any course given on the geography of Australia.

EDWIN J. FOSCUE

HILLYER, V. M. *A Child's Geography of the World*. 472 pages, ills. The Century Co., New York, 1929.

"When-I-was-a-boy in New England," explains Mr. Hillyer in his introduction, "we had for Thanksgiving six kinds of pie: apple, peach, cranberry, custard, mince, and pumpkin, but I was allowed to have only two kinds and I never could make a satisfactory choice. I have had the same difficulty in selecting geographical places and subjects to tell about. There are too many 'most important' places in the World to be included in this first survey, and there will inevitably be those readers who will wonder why certain countries and certain places have been omitted, especially the place where the reader may live."

A nine-year-old, however, has no use for a gazetteer of the world, be it never so well told, and the selection of facts to be presented to him is of interest only insofar as they hold his attention. The results of Mr. Hillyer's selection make no text to be hardly learned, but rather delightful fodder for busy young minds, which nevertheless contain many of those "most important" facts necessary to all good geographies, even elementary ones. The author's half whimsical way of telling about his subjects gives this geography almost a fairy-tale quality, so that the reader may be unaware of the number of facts actually presented. We may concede the author any amount of personal discrimination, but a tally of the contents lacks little except that "place where the reader may live."

"See how many things in Belgium begin with a 'B':

- "Belgium
- Bells
- Battle-fields
- Brussels
- Bruges

Bridges  
Boats"—

These are Mr. Hillyer's selection for Belgium, what nine-year-olds would care to read about. Mineral resources, manufacturing, and such formal terms will come later. You cannot absorb everything all at once. Persia is introduced with a Persian cat, and all its products are familiar to the author, hence to his reader—the rug at his feet, his wife's silk shawl, her turquoise ring and her perfume, his pearl scarfpin, the peaches he had for breakfast, and "The Rubáiyát" in his bookcase. Even the little girl who had a little curl reminds him of Persia, which has a very good part in its oases, but a horrid part in its desert. Twenty years of teaching young children gives one some idea of the sort of thing they like to hear about a subject that is new to them.

Until a few years ago, comparatively speaking, explorers and discoverers had a way of bestowing names descriptive as well as designative (if one may use such a term), and the interpretation of those old names seems to glue the meaning of the country to one's memory. Mr. Hillyer makes frequent use of this device, and he may enlighten some grown folks as well as help the children's memories. The story of Europa explains Bosphorus, which means "bull carry," and which is supposed to be the scene of the abduction. The Antipodes means "opposite-feet land." Argentina was "silverland" to the hopeful Spaniards, but in view of their disappointment and subsequent developments, the author explains that it would better have been called "meat-land" or "wheat-land."

Enthusiasm for simple explanations of phenomena which must be explained may lead to pitfalls, and we are wondering if in some instances this author is not giving his child readers a wrong impression. The Laplacian nebular hypothesis explaining the origin of the earth is certainly simpler than the planetesimal, but is it the one generally accepted today? Niagara may be the most famous waterfall, but is it always considered the most beautiful? "This mountain (Mt. Everest) is . . . more than five miles high—and yet it was once at the bottom of the sea. What a monstrous convulsion that must have been, when the land at the bottom of the ocean burst upward through the sea, on up to the sky!" We must protest, even though the aeons of slow uplift and erosion that produced the Himalayas and Mt. Everest cannot be so simply stated or comprehended.

But although geographies should be accurate, points like these are small pin-pricks in a work so generally good in its plan and execution as this. The grown-up who reads aloud enjoys the book fully as much as his young listener, perhaps more, for he has a longer view of the fanciful drawings which illustrate the whimsical tale. And for the child who reads by himself there is a pronouncing index at the end.

PRISCILLA H. WEBSTER



## ANNOUNCEMENT

THE series on the *Agricultural Regions of the World* is continued in this issue with the first instalment of *Agricultural Regions of Asia* by Dr. Samuel Van Valkenburg of the College of the City of Detroit. The next instalment of *Agricultural Regions of North America* by Dr. O. E. Baker will appear in the October number. This will be followed in a later issue by *Agricultural Regions of Africa* by Homer L. Shantz, President of the University of Arizona, and will complete the finest geographic discussion of the world's agriculture thus far published.

To obtain the complete series of these extremely valuable articles, which present for the first time on such a comprehensive and accurate basis the significant divisions of the world's most important industry, it will be necessary to subscribe at once for ECONOMIC GEOGRAPHY, and date back to the October, 1926, issue.

In addition to this series of articles on agriculture, other series are being initiated; every issue will also contain four or five articles dealing with urban and regional geography, with problems of land utilization, with programs of development of resources, with commerce, with transportation, with health, and with the hundred and one other subjects that are of present geographic interest, all by the most competent and best informed authorities in their respective fields. ECONOMIC GEOGRAPHY is indispensable to the intelligent citizen.

The subscription price to all new subscribers in the United States and possessions is \$5.00 the year or \$9.50 for two years. To all foreign countries, \$5.50 the year or \$10.00 for two years. Complete files from the beginning to include the numbers for 1931 may be obtained at the special price of \$32.50 for the United States and \$35.00 for all foreign countries.

## ECONOMIC GEOGRAPHY

A QUARTERLY journal of ECONOMIC GEOGRAPHY published by Clark University for the benefit of geographers, economists, teachers, professional and business men, and all who are interested in the intelligent utilization of the world's resources.

Subscription rates are \$5.00 the year in the United States and its Territories; \$5.50 the year beyond the borders of the United States, except to charter subscribers.

Only a limited number of the first issues of ECONOMIC GEOGRAPHY are available.

The April issue of Volume 7 contains the following articles:

*Agricultural Regions of North America*, Oliver E. Baker, U. S. Dept. of Agriculture.  
*Our Growing System of Inland Waterways*, Uthai Vincent Wilcox, Washington, D. C.  
*Abandoned Land in a Region of Land Abandonment*, L. A. Wolfanger, Columbia University.  
*Geographic Areas of Cities*, William T. Chambers, Stephen F. Austin State Teachers College.  
*Economic Adjustments in Liberia*, G. T. Renner, University of Washington.  
*The Italian Harbors on the Adriatic Sea*, Bruno F. A. Dietrich, Hochschule für Welthandel, Wien.

January includes:

*The Mesilla Valley of New Mexico: A Study in Aridity and Irrigation*, Edwin J. Foscue, Southern Methodist University.  
*Land Utilization in the Scablands of Eastern Washington*, Otis W. Freeman, State Normal School, Cheney, Washington.  
*Geographic Regions of Sierra Leone*, G. T. Renner, University of Washington.  
*The Indiana Oolitic Limestone Industry*, Stephen S. Visser, Indiana University.  
*Peanuts: Prices, Production, and Foreign Trade Since the Civil War*, Arthur G. Peterson, U. S. Bureau of Agricultural Economics.  
*The Gulf Port City Region of Texas*, William T. Chambers, Stephen F. Austin State Teachers College.  
*Chicory: Michigan's Infant Monopoly Crop*, Floyd A. Stilgenbauer, College of the City of Detroit.

The October issue of Volume 6 contains the following articles:

*The Great Basin*, J. F. Bogardus, Wharton School of Finance and Commerce.  
*The Sugar Industry of Mauritius*, C. J. Robertson, Istituto Internazionale d'Agricoltura, Rome, Italy.  
*Agriculture and Commerce of Uganda*, Earl C. Case, University of Cincinnati.  
*Lower Rio Grande Valley of Texas*, William T. Chambers, Stephen F. Austin State Teachers College.  
*Land Utilization in the St. Francis Basin*, Sam T. Bratton, University of Missouri.  
*The Lime Industry of Rockland, Maine*, Grant E. Finch, State Normal School, Danbury, Connecticut, and George F. Howe, State Normal School, New Britain, Connecticut.  
*Mountain Tops and Lowlands of Colombia*, Albert C. Smith, New York Botanical Gardens.  
*Glacial Topography and Agriculture in Central Massachusetts*, Berton R. Millington, Brown University.

July includes:

*Agricultural Regions of Australia*, Griffith Taylor, University of Chicago.  
*The Pastoral and Agricultural Industries of Kenya Colony and Protectorate*, Earl C. Case, University of Cincinnati.  
*Economic Adjustments in Bavaria*, Hubert A. Bauer, University of Washington.  
*Agricultural Regions of North America*, Oliver E. Baker, U. S. Dept. of Agriculture.  
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